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[OFFICIAL NOTICE.]

American Gas Light Association.

"SEC. 51. *No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.*"

This provision of the Constitution will be enforced at the coming meeting.

PHILADELPHIA, PA., Sept. 1, 1891.

Mr.....

The practice established a year or two since of collecting dues in advance of meeting has operated as expected, in facilitating the transaction of business at the meetings. It is especially necessary that this course should be followed this year.

Remittance may be made by check, post office order, registered letter, or by express. Address Drexel Building, Philadelphia.

The amount of yearly dues is shown below.

Attention to many matters, including the sending out of these notices, has been delayed by the long illness of the Secretary. By giving this your immediate attention you will assist in straightening out matters, and you will confer a favor upon

Yours truly,
ALEX. C. HUMPHREYS,
Acting Sec. and Treas.

Dues for year ending Sept. 30, 1892, $5.

[OFFICIAL NOTICE.]

Nineteenth Annual Meeting of the American Gas Light Association.

EXTRACT FROM THE CONSTITUTION.—"SEC. 12. *Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.*"

SECRETARY'S OFFICE, Sept. 9th, 1891.

Dear Sir—This circular is sent to many members of the gas fraternity who are not on our roll of membership; it is done with the object of pressing upon their attention the question of applying for membership in the Association. In these days of sharp competition, no gas man can, in my opinion, afford to remain outside of the Association.

Particular attention is called to Sec. 12 of the Constitution, as shown above.

The application calls for the endorsement of two active members. This should be borne in mind in connection with the Constitutional requirement above quoted, namely: That the *completed* application must be in the hands of the Secretary 10 days in advance of the meeting. Parties applying for admission will of course be welcome at the coming New York meeting, which is set for October 21, 22 and 23.

All correspondence, in regard to application for membership, should be addressed to me at Drexel Building, Philadelphia.

Yours truly, ALEX. C. HUMPHREYS,
Acting Secretary.

Drexel Building, Philadelphia, Pa.

MR. SAMUEL PRICHITT, President of the Nashville (Tenn.) Gas Light Company, died at his home in that city on the morning of Monday, September 21st, after a protracted illness. He was a member of the Western Gas Association, and also of the American Gas Light Association, and was known and respected by the fraternity the country over. His fortitude during an illness that covered a period of not less than five years was simply amazing. In due time we will give to our readers an extended history of his life.

BRIEFLY TOLD.

MATTERS CONNECTED WITH THE NEW YORK MEETING.—Acting Secretary Humphreys is having a busy time of it arranging for the routine of the coming meeting of the American Association in this city, and affairs are now shaping up so that he will speedily be in position to formally announce the numbers on the literary portion of the programme, as also the generally expected concessions that the trunk railway lines are to make in the matter of fares, etc. Some difficulty, in fact, more than usual, appears to have been encountered in securing papers for the convention, but the Secretary and the Council, by dint of persuasion, have finally been completely successful in obtaining a good number of contributors, who will present live themes to the consideration of the meeting. The Committee of Arrangements have about completed their labors, and the gentlemen composing the committee are to be congratulated on the scheme of entertainment perfected by them. It is novel and inviting; but such termination to their devisings could but be looked for when one recalls to mind their names. All are well versed in the art of entertaining, and with such a field as New York to work in, they had ample opportunity to display their talents as amusement providers. We look forward to a rousing meeting in New York, and it behooves the members to make their arrangements early at home, so that their presence in New York in October will be assured.

THE WESTERN CONTINGENT GETTING READY.—Writing of the attendance at the meeting puts us in mind of the fact that the Western contingent promise to come to town in solid phalanx, that indefatigable worker, Fred. R. Persons, of Chicago, having very sensibly determined that, if possible, the trip East should be made in true regimental fashion rather than after the style of the awkward squad. Perhaps the following circular letter, that is being distributed amongst the Western gas men, will best explain just what is proposed in the direction indicated:

CHICAGO, Sept. 19, 1891.

Dear Sir:—Are you going to attend the American Gas Light Association meeting, in New York, October 21st to 23d? Can you arrange to go by way of Chicago, leaving Chicago, Sunday, October 18th at 3:10 P.M., spending part of the next day at Niagara Falls, and arriving in New York, Tuesday, the 20th?

The Michigan Central and N. Y. Central Railroads will furnish us a special Pullman car at no additional expense over the regular rates, and give us every convenience and attention. If you would prefer to leave on Monday and go direct, without stopping at Niagara, please state it in your reply. We will be governed by the majority. An early reply will assist the Committee in perfecting arrangements.

Yours truly,
FRED. R. PERSONS.

Mr. Persons requests that all replies to this circular be addressed to him at No. 75 North Clinton street, Chicago.

THE GAS CLUB of CHICAGO.—Some weeks ago we spoke of the probable formation at Chicago of a Society of Gas Engineers, to be modeled somewhat on the lines of the Society of Gas Lighting, or the Guild of Gas Managers, and we can now say that the organization was perfected on Wednesday last, at a meeting held at the Grand Pacific Hotel, Chicago. The 25 who responded to the call included many gas men of prominence in the West and all were enthusiastic partisans of the proposed Society. The name adopted was that of The Gas Club of Chicago. Mr. E. G. Cowdery, of Milwaukee, was chosen Temporary President, and special committees to report a set of laws, to nominate officers, etc., were appointed with instructions to hand in their conclusions at the next meeting, which was named for an early date. The Club is bound to be a success.

NOTES.—President John P. Harbison, of the American Association, has been indisposed for some days, but his rugged physique and abundant pluck make a very poor combination for illness to prevail over.—And this leads us to say that Mr. W. W. Goodwin is mending so rapidly that his return to active business is but a question of a short time.—The Newark (N. J.) Gas Light Company is completing the laying of a 10-inch main from its works on to and through the chain of handsome towns that comprise the Orange districts.

[A paper read before the Society of Gas Lighting.]

Basic Units of Economy in the Manufacture of Gas and Electric Lights.

By MR. R. B. TABER.

My attention was attracted to the discussion of a basic unit of economy in gas manufacture which virtually formed the subject under another name of quite a discussion in the meeting of the Western Gas Association at Louisville. Under the *regime* of the Gas Commission in Massachusetts the yearly returns of each company are made up in a form prescribed by them, and the relative economy of different plants, their status before the Board, and the protection or control, perhaps their very immunity from attack, may depend upon the returns thus rendered, based on the relative unit of cost per 1,000 cu. ft. sold. To obtain this the itemized figures might be divided as follows:

1. Cost of manufacture, or the efficiency of the apparatus—say, coal, enrichers, water, labor, repairs at works.
2. Cost of distribution, or the efficiency of the street mains—say, wages of meter takers, repairs to meters, repairs to mains.
3. Cost of office, or the efficiency of the personnel and general staff.
4. Cost of capitalization, or the efficiency of the capital—say, taxes, legal expense, etc.

The further items of depreciation and interest are carried to separate accounts. This unit coincides also with the English system, and so general has the habit become that many of the new patent processes have taken advantage of the custom and cry up 15 cent wares, trusting that the cost of manufacture covering only a few of the items specified above may be confounded with the total cost delivered, as indeed it is likely to be by inexperienced investors. It would be better, then, that similar discussions to those at Louisville might be held to determine a basis upon which gas engineers may agree as to the relative cost of gas making; for it was evident in the discussion the Massachusetts standard was not in use in Rhode Island; and an engineer may be of good standing and show creditable reports in one State and be misunderstood or underrated in another. Or an investor may trust in certain reports to great disadvantage by simply relying on an "eminent" engineer's statement of the cost of gas as made by a certain process.

In my own case, where it is often necessary to make comparison of the efficiency of gas plants with that of electric plants, and *vice versa*, I have been compelled to adopt another system in which the cost of gas and electricity is expressed in decimal percentages of the total income, thus affording a less circuitous route to the result wanted; in other words, expressing the unit of sufficiency, not in number of feet, or more properly, candle feet, of gas sold, but in the income received for that amount of gas—conditions made necessary in selling electricity, since the number of arc lights or incandescent lights, or even the number of watts sold, has no special significance, and is extremely difficult to obtain. In electricity, therefore, the items arranged as before, viz.:

Cost of manufacture, including coal, water, oil, waste, labor, and repairs at station;

Cost of distribution, including wages, repairs of lines and meters;

Cost of management, including superintendent, office expenses, horse hire, etc.;

Cost of capitalization, including taxes, legal expenses, insurance, etc.;

are summed up relatively to the total income, and are expressed in percentages of the same.

For instance, in 49 electric stations whose reports are made monthly and cover a period of 15 months I found

6	Companies	report	the	rate	of	expense	to income	to be 50 to 60 per cent.
13	"	"	"	"	"	"	60 to 70	"
20	"	"	"	"	"	"	70 to 80	"

Ten above this limit, or a total average of 69 per cent.

You will notice that neither in the Gas Commissioners' report nor in the above enumeration of expense is any allowance made for depreciation and interest, which are carried into the profit and loss accounts and do not figure in the relative efficiency of staff and apparatus. As a matter of fact there is probably some error arising from this source in the following averages deduced from the last published Commissioners' report, yet the figures given are approximate. Thus, in the towns whose annual consumption is over 25,000,000 cubic feet,

2	report	a	ratio	of	expense	to total	gas and residual	income of 50 per cent.
12	"	"	"	"	"	"	60 to 70	"
5	"	"	"	"	"	"	70 to 75	"

And of the 73 companies of the State the average would be slightly higher.

Such figures are less scandalous and alarming surely than the old piratical stories of gas costing 15 cents, 9 cents, or even 3 cents, so often heard, and allow a fair business comparison with other manufacturing industries breaking through the long continued isolation of the gas business, which has oftener proved a curse than a blessing.

I have said that the matters of depreciation and interest are referred to profit and loss accounts rather than to expense accounts, and scarcely affect the subject of the unit of efficiency. When carried to expense, as depreciation sometimes is, it is a variable quantity, based, of course, on the amount of the repair account each year.

In few cases that I know is a direct charge made in the gas accounts; fewer still in electrical returns, where seemingly more necessary. I say seemingly, because it is the general impression that the repair and depreciation accounts in electric stations should be very large, and I was somewhat surprised to find, in the 49 stations quoted above, that the actual cost of repairs averaged in the total cost of the stations—

For repairs and renewals of	lamps	2.98	per cent.
" "	lines	1.37	"
" "	dynamos	1.23	"
" "	station	1.34	"
" "	engines	.95	"
" "	boilers	.96	"
Or		8.83	per cent.

It may be presumed, then, that a station well kept up and well repaired will depreciate only by the loss of renewals as the business increases; nor are the new patents superseding and making valueless the earlier form of apparatus. The first Brush dynamo is still running, and high speed Armington & Sims engines at the end of five years are practically as valuable in a station as when first run; and it seems to me a proper repair account will quell that picture of an exhausted treasury depleted by the phantom of an immense friction silently wearing away dynamos, lines, poles, etc.

It is, of course, certain that in a poorly managed station, as in a poorly managed gas works, a wonderful amount of damage can be done in a wondrously short time. An armature can be ruined, or broken flywheels send tons of iron skyward as readily as gasholder tanks or purifier roofs can fall; but such things are not common. I quote from the experience of the Electric Mutual Insurance Company, of Boston, which covered about $3,000,000 of electric property during the year 1890, that their loss was but $133.05. The report of the Committee of this Society, placing "daily expense, taking interest, insurance and depreciation, at 16 per cent.," is undoubtedly excessive in the light of to day. For this last item of interest is so strictly outside the ken of the gas engineer that it might be said of it that it is a matter over which, like the watery skies, he has absolutely no control. The Commission's report, however, has some curious figures, if placed in juxtaposition, and will prevent any hasty criticism that our methods are better than our father's in the manipulation of stock companies, and show also how in good hands good investments can be made a success. For if we compare capital on which interest is based and income in the more important towns of the State, the ratio of gas and electric income in each city to the total invested is surprisingly similar. Boston, Lynn, Worcester, Salem, are good instances of this and serve to show that the interest ratio would not materially affect the unit of efficiency which I have adopted for comparison for working of gas and electric light plants.

Gas Supply in the Hands of Local Authorities.

[A paper read by Mr. J. Hepworth before the English Association of Local Boards.]

The subject of gas supply is one of considerable importance to local authorities; and while it has not been neglected by them in the past, it should continue to receive their careful attention in the future.

Although gas for lighting and other purposes has only been introduced within the present century, it has practically become one of the necessaries of life; and notwithstanding the competition of other illuminants, there is no evidence as yet that it is likely to be superseded—its use, both for lighting and heating purposes, being largely extended every year.

There are at the present time some 1,600 gas works in the United Kingdom; and from the return relating to all the authorized gas undertakings, it appears that 578 out of the total number of works have been sanctioned by Parliament. Of the authorized undertakings, 405, or about 70 per cent., belong to companies; and the remaining 173, or nearly 30 per cent., belong to local authorities. The capital employed in the gas works of the United Kingdom has recently been estimated at £100,000,000; but the total capital employed in the authorized gas undertakings only in 1890 was as follows:

Authorized Gas Undertakings.	Total Number.	Capital Employed.	Per-centage.
Companies	405	£38,207,748	63.81
Local authorities	173	£21,669,789	36.19

The local authorities, with the exception of a few instances, did not undertake the responsibility of gas supply when gas was first introduced. It was only after it had been proved to be a great public convenience, and its supply had been established as a commercial success, that public bodies, as a rule, became convinced of the importance of undertaking the supply. Some of the arguments adduced for local authorities assuming this responsibility are: That gas is a public necessity; that its supply has become a monopoly; that the supply of a commodity necessitating frequent interference with the public thoroughfares should be in the hands of the public authority having charge of those thoroughfares, and not of private individuals; that the security of the public rates enables local authorities to raise money at a cheaper rate than gas companies, and therefore to manufacture gas at a less cost than companies can; and that any benefits derived from the supply of gas should go, not to private individuals, but to the public—either in the promotion of public improvements, the reduction of the public rates, or reductions in the price of gas.

There is no necessity to discuss these arguments now. They have been advanced with more or less force by local authorities; they have been sanctioned by the Legislature; and the following General Acts of Parliament for establishing or acquiring gas undertakings have been passed as the result: The Gas and Water Works Facilities Act, 1870, and its Amendment Act of 1873; the Public Health Act, 1875; and the Burghs Gas Supply (Scotland) Act, 1876. The public Health Act, 1875, enables urban sanitary authorities to become suppliers of gas by the purchase of gas undertakings already in existence, and to supply gas within their district by themselves erecting gas works under the powers of a Provisional Order to be granted by the Local Government Board, or by obtaining a Special Act to effect the same purpose. The Burghs Gas Supply (Scotland) Act, 1876, also confers similar powers upon local authorities in Scotland.

The powers conferred by these several Acts have been extensively used, albeit not so extensively as seemed probable at one time; and some of the largest provincial gas works have now been acquired by local authorities, and are supplying gas to areas much larger than the district of the authorities in question, and with manifest advantage to all concerned.

It is unnecessary to discuss the relative advantage of a Special Act or a Provisional Order enabling a local authority to acquire a gas undertaking; these can only be determined on a full consideration of the circumstances in each case. But wherever a local authority finds it desirable to supply gas outside its own district, it is then necessary to obtain a Special Act; and the fact may be noted that there are comparatively few authorities supplying gas who have not found it either desirable or necessary to have a Special Act for the purpose.

The Legislature does not give power to local authorities to compete with any authorized gas undertaking; but there are instances where local authorities have succeeded in obtaining powers to establish gas works in districts in which a company has already been legally authorized. In all cases, however, Parliament has properly refused to assist in confiscating the property of the private company, and has limited the powers of the local authority to a supply of gas to the public lamps and other public purposes of such local authorities. It need scarcely be said that such a limitation precludes the possibility of any advantage whatever to the local authority; and the loss of the public lighting has not in all cases proved to be a disadvantage to a gas company. In cases where gas works already exist, the only way in which the local authority can succeed in effecting any beneficial result is by first buying up the established company; and wherever a local authority has succeeded in obtaining the powers of supply, it has been with the condition attached that the rights of the existing company should be purchased by the local authority.

The capital employed in the gas undertakings of local authorities has already been given at £21,669,789. The terms allowed for the redemption of this capital vary from 30 to 100 years. But the usual maximum is 80 years; and the tendency of late has been to reduce that limit. In the author's judgment 50 years ought to be adopted as a minimum term for the repayment of capital employed in gas works. With a less limit than this, there is an inducement either to erect works of an

imperfect character, or to allow the works to become dilapidated. The result in either case is that the cost of maintenance becomes ultimately excessive; and the excessive cost of gas under such conditions follows as a natural sequence. On the other hand, if the works are properly constructed in the first instance, and the cost of maintenance is kept reasonably low, the works may prove a valuable asset even at the end of 50 years. Moreover, when gas companies authorized by Parliament are permitted to maintain their capital in perpetuity without any reduction, the conditions imposed upon local authorities, of repayment within a shorter period than 50 years, become not only onerous, but retard the benefits which ought to accrue to local authorities in the earlier periods of their gas undertakings.

The rate of interest at which local authorities have been able to raise the capital employed in their gas works varies from 3 to 5 per cent.; but it is not now necessary to give much more than 3 per cent. The importance of this fact may be estimated when it is remembered that the dividend paid on capital employed in the authorized gas works owned by companies in 1890 averaged £8 11s. per cent. There can be no doubt as to the advantages possessed by local authorities over gas companies in respect to the terms on which they are able to raise capital; and assuming that a gas undertaking has been acquired at a reasonable price, and that other things are equal, the possession of the undertaking ought to prove a substantial public benefit.

The terms upon which the transfer of a gas undertaking to a local authority takes place are usually arrived at by arbitration; and in the case of a statutory company, the amount in recent years has varied from 25 to 28 years purchase of the maintainable profits—the amount differing according to the circumstances of the case. When the undertaking is not an authorized one, the value is proportionately less, and has in several instances been taken at about 20 years' purchase of the maintainable profits—circumstances again governing the amount awarded.

The benefits which have accrued to the local authorities from the possession of gas undertakings have been greater than is generally recognized; and if, in exceptional cases, gas works in the hands of local authorities have not proved so profitable as might have been anticipated, this has usually arisen from mismanagement on the part of the authorities themselves. The benefits arising from the profits derived from the gas supply and from reductions in the price of gas may be especially noted.

Profits from the Gas Supply.—There are differences of opinion as to the advisability of local authorities supplying gas at a profit; and the Burghs Gas Supply (Scotland) Act, 1876, expressly provides that the gas shall be supplied at such a price "as will, as nearly as can be estimated, raise sufficient income to discharge all the costs and expenses of and incident to the manufacture and distribution of the gas made, together with the interest on all money borrowed in respect of the works, and to provide the sinking fund required by this Act, and to provide for a depreciation and renewal fund sufficient to maintain the works in perpetuity, and for all charges incident to the occupation of such works; and the moneys received in respect of and incident to the manufacture and distribution of gas shall be applied to such purposes only, and any balance at the termination of every year shall be carried to the debit or credit of the succeeding year." That is to say, no profit is to be made. This provision of the Burghs Gas Supply (Scotland) Act, 1876, has not been incorporated in any Act relating to England and Wales; and the practice of the local authorities accordingly varies.

The total amount of net profit actually realized by local authorities on their gas undertakings in 1890, after payment of interest on loans, annuities, repayment of loans, and amount placed to redemption and sinking fund, was £486,483, which is equal to 2¼ per cent. upon the gross amount of money borrowed, not deducting the amount repaid. As 2¼ per cent. does not represent the whole of the difference between the rate of interest or profits paid upon the capital employed in the gas works of local authorities and of gas companies, it may be safely assumed that the consumers have not had to pay a higher price to local authorities for their gas than they would have been called upon to pay to gas companies; but, when examined, the prices charged by local authorities for gas prove that this is so.

The net profit referred to, amounting to £486,483, has been applied in various ways, viz., to a reduction of the capital account; to extension of works; to meet deficiencies in the water accounts (as was lately proposed also in the Manchester Corporation); to the free lighting of the public lamps; to defray the cost of the electric light, the cost of municipal buildings, markets, free libraries, and public improvements; and to the city or borough fund, and also to the district fund, in aid of rates. There may be some doubt as to the wisdom of such application of gas profits; but the fact remains that a sum of nearly half a million pounds sterling was thus applied last year. The effect of such an application of profits is to maintain a higher price for gas than is absolutely necessary. If such a policy can be justified at all, it may, perhaps, be justified by the theory that a local authority has a right to make as much profit as a private company would be allowed to make in similar circumstances.

The author's view is that all local authorities should follow the practice compulsory upon the local authorities in Scotland, and sell gas at cost price, certainly within their own district, and especially when "cost price" does, and in every case must, include the amount necessary to extinguish the capital of the undertaking within the prescribed number of years. The price at which a local authority should supply gas to an outside district may, as in the case of companies, very properly be in excess of that charged within its own district; and the amount of the excess is usually regulated by the distance which gas is conveyed, the consumption per mile of main, and other local circumstances. If the gas supplying authority derive a reasonable margin of profit in such a case, it should not lead, as it sometimes does, to discontent on the part of those receiving the supply. A legitimate profit is not only reasonable, but in the case of a local authority will probably be less than would have been paid if a company had supplied the gas; and if the profits are being contributed by one district to an adjoining district, the hardship, if it be one, is no greater than would exist if the profits had been contributed to a gas company, whose shareholders might by chance reside in every district in the United Kingdom. As I have said elsewhere, however, it must be left with the local authorities themselves to determine their own policy in this matter.

Price of Gas.—The lowest price charged for gas in the United Kingdom in 1890 was 1s. 9d. per 1,000 cubic feet; and the gas was supplied by a company. The lowest price charged by any local authority was 1s. 10d. per 1,000 cubic feet. If it be true, as is sometimes alleged, that the price charged for gas supplied by the local authorities is higher than it need be, it cannot be said that it is anywhere excessive when compared with the prices charged by companies under similar conditions; and certainly the price of gas has been steadily reduced by nearly all local authorities when they succeeded to the gas undertaking of their respective districts.

One of the greatest hindrances to the reduction in the price of gas in the case of local authorities arises from a tendency to entrust the management of their works too much either to members of such authorities or to incompetent managers; and this tendency exists not only in small gas works, but in several of the largest in the country, and is absolutely without excuse. There are notable instances of local authorities, selling gas at admittedly low prices, who, if their works were under good management, could largely reduce the cost of production, and effect the annual saving of large sums of money now being wasted; but this economy might involve new principles of management, the introduction of better qualified officers, and possibly an increase in salaries. In the interests of economy and efficiency, however, and also with the view of improving the quality as well as reducing the cost of gas, local authorities would do well to consider the possibility of improving their methods of management.

From the fact that there have been only 25 gas undertakings acquired by local authorities during the last eight years, it may be inferred that the introduction of the electric light has had, and still has some influence in deterring these authorities from assuming such risks as are attached to the supply of gas. It has already been stated, however, that, notwithstanding the competition of all other lighting agents, the increase in the consumption of gas continues from year to year. The value of gas undertakings, therefore, has in no degree been depreciated in consequence of that competition—indeed, their value has been, and still is steadily increasing; and it is a striking fact that the consumption of gas for other purposes than lighting (the "day" consumption as it is termed) is not only extending, but in some towns now amounts to 50 per cent. of the total consumption.

The obvious conclusion is that those who are in possession of authorized gas undertakings have no reason to fear the future of their industry; and, speaking from a 25 years experience as the engineer of gas works belonging to local authorities, the author is of opinion that authorities either in possession of, or seeking to possess such undertakings, will find that gas works in their hands will continue to be one of the most valuable of their undertakings.

THE Company furnishing natural gas in the cities of Oil City, Titusville, Meadville and Franklin has notified the residents that on and after Oct. 1st all gas supplied will be on the basis of the meter system, the gross rate to be 20 cents per 1,000 cubic feet.

[A Paper read before the National Electric Light Association, by Mr. Geo. A. Redman, Rochester, N. Y.]

Central Stations Operated by Water Power.

The purpose of my paper is more to give a description of what is being done with water power for electrical purposes in the city of Rochester by the three different electric light companies doing business in that city, and some of my own experience with water power, than to take up your valuable time with the technical description of turbines, which can be gleaned from any of the numerous catalogues of turbine manufacturers, which contain full descriptions of turbines and their construction.

The adaptation of water power for electrical purposes has grown very rapidly within the past few years. There are several causes operating to enhance the value of water power, none more so than that of electricity.

Streams that have had no pecuniary value heretofore are now being utilized for the purpose of running electrical machinery, yet at the same time the supply of water is diminishing, caused by the destruction of forests, and water right owners in various parts of the country are devising means of storing water during the rainy seasons to furnish a supply during the dry season; also storing it in the daytime for night use. One large water right owner in western New York, during the months of July and August, places flash boards 2½ ft. high on top of his dam, at an expense of $100, and stores up for night use the water which is not necessary for him to use in the daytime, thereby saving in the two months a coal bill of $2,100.

The Johnstown, N. Y., Electric Light Company have improved their water power at the Cuyadota Falls by erecting a dam 34 ft. high on top of the falls, giving them a total head of 75 ft. and nearly doubling the amount of power.

A survey of the upper Genesee river, between Mount Morris, N.Y., and the celebrated Portage Falls, has been made during the past year for the purpose of establishing a reservoir that will furnish the city of Rochester 30,000-horse power more daily during the entire year than they have at present.

The earliest forms of water wheels were the paddle and flatter wheels that only utilized the impulsive action of the water; these were followed by simpler wheels of the reaction type and others.

We now have the improved forms of the Leffel, Victor, Lesner, Success, and many others. There is a demand for the best and most economical turbine that can be manufactured.

Turbines should be built to secure the delivery of the water upon the turbine without checking the velocity of the water more than one-third, and permit the free discharge of same after passing through the turbine, and to work with as good efficiency under part gate as under full gate, and to be made of the best phospher bronze, to stand the wear and tear under high heads.

It is essential in locating central stations to be run by water power, to locate them where there is no great danger of a flood, or so protected by a breakwater as to make it perfectly safe, and also to avoid trouble with backwater upon the turbines.

Where a station is situated on the bank of a river it is best to take the water from the river by means of a raceway, with the headgates parallel with the flow of the water, and at times of a freshet or running of anchor ice, it will more than pay any expense incurred by so doing.

The raceway should be of a sufficient depth and width to permit the water to flow not more than 90 ft. per minute, and a waste gate should be placed in the side or end of the race to use in case of emergency; and when cleaning out the raceway a rack should be built across the race to prevent driftwood and other rubbish from passing into the turbines.

For that purpose I would recommend a rack built of iron slats 2 in. wide, one-eighth of an inch thick, and placed five-eighths of an inch apart on seven-eighth inch iron rods, at an angle of 45°. Particular attention should be taken to keep the rack clean by raking. A trough or platform should be placed over and immediately back of the rack to rake the rubbish and anchor ice into, and so arranged that a current of water from the race will pass through the trough and carry off all of the rubbish, etc. For any station that is using 100-horse power or over, it will be a great saving in labor to them and pay well for the extra expense. For winter service a boom should be placed in front of the headgates, and the current will carry off a large portion of the anchor ice and other floating objects.

The headgates should be built to work with a rack and pinion; also a roller should be placed back of each gate stem to facilitate the handling of the gate.

The gates should have a protection built over them, to protect the gearing from the storm. In a cold climate, where the gates are apt to be frozen in, salt is essential in freeing them from ice; all headgates and timbers should be of the best quality of oak, and should be well bolted, and not less than two gates to one raceway. The tail race should have not less than 2 to 3 ft. of dead water when the wheels are not in motion.

Where the tail race runs under the station, cement floors should be laid to prevent moisture in the station; a floor of that material will soon pay for itself.

Vertical turbines should be placed so that the steps are covered with water at all times. In adapting turbines to very high heads, or to conform to location, it becomes necessary to set the turbines above tail water and conduct the water away from the turbines, through a draft tube: the same depth of pit and area of discharge is required where a draft tube is used, as would be when the turbines are set at the bottom of the fall; the mouth of the draft tube should always be submerged about 6 inches in standing tail water. It is claimed that draft tubes can be used 30 ft. in length. I do not think a draft tube more than 18 ft. in length should be used on account of the difficulty in keeping the tube airtight, for if the tube leaks the vacuum is imperfect and there will be a great loss of power, and where steps are used they will be apt to be burned out.

When possible, I would advise horizontal turbines to be used, as they are easier taken care of, and many of them are used without any steps. The burning out of steps is an expense and annoyance. One of the greatest advantages in the horizontal turbine is that the dynamo can be belted direct to the turbine shafting, and is in some cases coupled direct to turbine, making a good percentage in economy in power and advoiding the use of gearing, and I deem it advisable to put in a number of small turbines, in one large one; in case of a break down, they are more easily repaired and cause less delay to customers.

In the old station of the Brush Electric Light Company, of Rochester, the vertical turbines caused considerable annoyance in the burning out of steps and stripping of the gears; so much so, that it became necessary to support the vertical shafting with water cushions. For wooden steps we have had the best success with lignum vitæ.

In my opinion, governors for the turbines are necessary and will govern any slight variation of load under high head, but where one-third or over of the load is thrown off or on suddenly, it is necessary to handle the gate by hand, as under the above circumstances the turbine is apt to slack down or run far above the normal speed, as the case may be; in the latter case causing the burning out of lamps and armatures. The governors should be placed as near the turbines as possible to save lost motion in the gate shafting and avoid the use of gearing as much as possible.

We have two governors in use in our office building under a low head of 16 feet, and they govern the turbines under all circumstances in quite a satisfactory manner.

The decided advantage of a water power station over one run by steam power, is not only one of economy in the saving of the expense of coal, but the station and apparatus can be kept cleaner and cooler, thereby saving considerable in expense of repairs, and it is also far more pleasant for the employees.

The Brush Electric Light Company, of Rochester, purchased the entire lower falls of the Genesee River (which is about two miles from the business center of the city) some nine years ago—at that time it was looked upon by many as a piece of folly, to think of running dynamos there, on account of the distance from the business center of the city and the dampness around the Falls. Notwithstanding the adverse opinions, they erected two buildings on the west side of the river above and near the brink of the Falls, and put in two 30½ inch Leffel, two 20 inch Victors and one 40 inch Leffel turbine, the first four mentioned turbines, under 94 feet head, and the latter under 28 feet head, with a total of 2,500 horse power. After running this power for five years they built a new station and leased their old power to different parties for pulp and flour mill purposes.

The new station is a three story stone building, 45 feet wide and 90 feet long, with a two story brick addition 42 feet wide and 80 feet long, and located at the foot of the Falls on the east side of the river. The turbine capacity consists of 15 double 15 inch horizontal Lesner turbines under 90 foot head, with 14 foot draft tubes, a total of 3,360 horse power, using 6.95 cubic feet of water per minute per horse power; have had but one turbine damaged to any extent in four years. The turbine casings are placed on iron girders with the ends of the girders resting on solid rock.

The amount of floor space occupied by all of the turbines is 4 feet by 38 feet; the weight of each turbine is 196 lbs., less than one pound to a horse power; each turbine is placed in a separate division of the casings

and the shaftings extend through the shafting room, upon iron bridge-trees, with seven feet and six inches between journals, and the dynamos are belted direct to the turbine shafting ; the shafting runs at 800 revolutions per minute, with 25 inch pulleys on the turbine shafting and 24 inch on the dynamos ; we use untried beef tallow for lubricating and are well satisfied with its results. The turbine gate shafts and governors are placed in the dynamo room at an average distance of 14 feet from the turbines, where they are easily handled by the attendants. A tell-tale is placed in the shafting room, connected to a float in the race above the Falls, which shows the height of water in the race at all times.

The water is taken into the raceway, about 80 feet above the Falls ; the race is 32 feet wide, and five feet six inches deep, and cut through the solid rock ; there are four headgates with a house built over them ; a wooden diagonal rack is placed in the race near the spillway to assist in freeing the race from anchor ice ; the spillway is six inches deep and 32 feet long. The waste gates are placed next to the spillway and are three feet six inches wide ; there are two of them. In front of and near the top of the penstocks an iron rack is built according to dimensions given; also a rubbish trough.

There are three iron penstocks, six feet in diameter and 80 feet high ; built of three-eighth inch boiler iron, with a gate to each penstock. There are five elbows to each penstock leading to as many turbines, with an iron slide gate to each elbow ; in addition, each turbine has a register gate, thereby permitting the repairing of any one turbine without interfering with the running of the others. A turbine can be taken out and another put in its place in 25 minutes. Cement floors are laid in the shafting and turbine rooms.

There are three tail races, extending under the entire length of the main building ; each race is nine feet wide and six feet and six inches deep.

As a reserve power, when making repairs and cleaning the raceway, we have a 600 horse power Cooper Corliss engine ; in the past year it has been necessary to use it but a few days.

For fire protection, two-inch iron pipes are run from the penstocks through both buildings with four lines of hose attached at all times ; the hose is tested once a week ; in addition to the hose, a dozen fire pails filled with water and placed in different parts of the station are kept in readiness, and are not permitted to be used for any other purpose.

A record is kept of the time of starting and stopping of each turbine, also the speed and load on same, and any variation in height of water, and all repairs that are made. In addition to the above records, the day and night wheelmen report the condition of the power at the time they are relieved.

There are nine men employed at the station, five of them in the dynamo department and four in the water power department. We have in service 30 dynamos ; three of them are run without any stoppage and the balance of them on an average of 13 hours per diem. A record book is kept in the dynamo room, in which entries are made of the time of starting, stopping, speed and load of each dynamo, also all repairs of every description, all accidents to either machinery or circuits, nature, time and cause of same. All the circuits are tested five times daily, and the tests and time of same entered in record book.

By the means of water power the company is enabled to furnish cheap and satisfactory light and power at the following rates, viz.: City arc lights, all night and every night, 27 cents per night ; commercial arc lights, all night and every night, 40 cents per night ; commercial arc lights, evening, 25 cents per night ; commercial arc lights, evening and all day, 40 cents ; ¼ horse power motor, $18 per annum ; ½ horse power power motor, $48 per annum ; 1 horse power motor current, $72 per annum ; 2, 4 and 6 horse power motor current, $50 per annum per horse power ; 8, 10 and 15 horse power motor current, $40 per annum, per horse power ; ¼ horse power fan motors, $15 per season, from June 1st to October 1st ; 16 candle power incandescent lamps, $5 to $12 per annum ; 25 candle power Bernstein lamps, $12 per annum ; 50 candle power Bernstein lamps, $24 per annum ; 100 candle power Bernstein lamps, $48 per annum.

The rates I have mentioned are for arc circuits ; our rates for current on 500 volts constant potential circuits are as follows, viz.: 1 horse power, $48 per annum ; 2 horse power, $96 per annum ; 5 horse power, $180 per annum ; 8 horse power, $240 per annum ; 10 horse power, $300 per annum ; 15 horse power, $450 per annum ; 20 horse power, $600 per annum.

We operate a total of 832 motors, of which 196 are fan motors, 1,396 arc, 135 Bernstein and 200 Swan incandescent lamps. One motor circuit contains 26 miles of outside wire and 394½ horse power "C. & C.," one 2 horse power and one 4 horse power Brush motors, and is run with a No. 8 Brush arc dynamo. We have one 40 K. W. 500 volt "C. & C." generator in service, on an eight mile circuit, with 48 horse power in motors in use ; the ammeter averages 29 amperes. We experience no difficulty in running same with our power.

The rebate for poor service during the year ending December 31, 1890, was one one-hundredth of one per cent. of the gross receipts, and the uncollected accounts for the same period was one-tenth of one per cent. of the gross receipts.

The Edison Electric Light Company have recently erected a three-story stone station at the foot of the upper Genesee Falls, on the west side of the river, and have at present two double discharge Leffel mining wheels under about 90 feet head, giving six hundred horse power, and are placing two more of 400 horse power each. In addition, they have a fine steam station in the center of the business district. Incandescent 16 candle power lamps are furnished at one cent per lamp hour ; arc lamps for city use, 28½ cents per night ; municipal incandescents at six cents per night. The latter they are partially replacing with arc lamps. They have in circuit 105 arc, 805 municipal and about 13,500 16 candle power incandescent lamps.

The Rochester Electric Light Company's plant is situated at the upper Genesee Falls, on the east side of the Genesee River, near the business center of the city. The station is three stories in height from the top of the Falls, with the wheel pit underneath, blasted out of solid rock 95 feet in depth. They have five Leffel horizontal turbines ; four are 23 inches, and the other 80½ inches in diameter, with a total of 1,500 horse power, undear a head of 86 feet and eight inches.

The penstock is a steel pipe seven feet in diameter ; the power is transmitted to five shafts 80 feet above by belts 173 feet in length, running at a speed of 7,200 feet per minute.

The dynamo room is directly over the shafting, from which all of the dynamos are belted through the floor. The dynamos are the United States system.

They have in service 325 city arc and 140 commercial arc lamps ; also 1,500 incandescent lamps and two 10 horse power motors. They have just placed one 85 horse power generator and one 1,500 light Westinghouse alternating dynamo. As a reserve power, they are putting in a 400 horse power engine. The city lights are being furnished at 27 cents per light.

In addition to those I have mentioned, there are five incandescent plants and one arc isolated plant run by water power in Rochester, some 500 incandescent and 25 arc lamps, making a grand total of 1,991 arc and 16,640 incandescent. The population of Rochester is 135,000, making a very high average per capita.

Electric Lighting in London.

Engineering, in the course of an article on the advance of electric lighting in London, remarks that after being for many years behind every other important city in Europe and in America in the matter of electric lighting, London has suddenly distanced all its Continental rivals, and is within a measurable space of surpassing New York. This change has taken place in a very few years, and originated in the Electric Lighting Amendment Act of 1888. Previously to that scarcely anything had been done in the way of public lighting, if we except the operations of the Grosvenor Gallery Company and the Cadogan Electric Lighting Company of Chelsea. But on the passage of the new law there was a rush for provisional orders, and now there are already 240,000 lamps of eight candle power under supply, as noticed by us in our issue of August 21. These figures, as we then stated, were taken from a report in the *Times*, which went at considerable length into the causes, first, of the slow progress of electric lighting in London in the years 1882–1888, and, second, of the late rapid burst. In finding a reason for the long delay, the *Times* did not attribute it entirely to the effect of Mr. Chamberlain's Act, which provided that a municipality might buy out a supply company at the end of twenty-one years, without any compensation for compulsory purchase or goodwill. On the contrary, it held that electric engineers were not in a position at the date of the Act to carry out any ambitious schemes, and that if it had not been passed the progress must have been much slower than of late. There was a great eagerness at the time to invest money in electric companies, and if an artificial barrier had not been raised, when "the finance of the question had outstripped its science," it would have been found how incomplete the science was. This view of the subject brought a letter from Mr. R. E. B. Crompton, who in contradiction of it repeated his well known assertion that the station which he designed for the Edison-Swan Company in 1883, and which was partly installed in Pimlico, was quite capable of effecting the lighting of Victoria and the

adjacent streets, and of earning fair dividends. Mr. Crompton admitted that immense strides had been made in the interval in the use of alternate currents, and that continuous current dynamos had been improved, but he insisted that in 1883 there was ample knowledge to proceed upon.

The two views thus put in opposition are those of the shareholder and the engineer. Of course when the latter asserts that his plant would have earned satisfactory dividends he goes beyond his province; as yet we have very little knowledge of the capabilities of electric supply companies to make profits. The shareholder has no enthusiasm for science; on the contrary, he has a profound dread of making experiments. What he delights in is a simple manufacturing process with a monopoly of sale. He knows that under the best of circumstances profits are not excessive, and that it needs very few adverse circumstances to eat them up altogether. Such a man naturally thinks that if he had put his money into an electric supply company in 1883 he would have seen very little return for it in the years that have since elapsed. He sees that dynamos have increased in size several times; he hears that their efficiency has much improved, and he knows that English engineers have now the advantage of much Continental and American experience. He is aware that, as yet, the bulk of the public hold back from the new illuminant, and that very little profit has been made. No wonder he thinks that eight years ago engineers could not carry out electric lighting work successfully, that is, in the sense of making it pay. Probably he is right. We quite accept Mr. Crompton's statement that his Victoria Station was capable of supplying 20,000 lights, but we think that he does not do full justice to all the scientific advances he has himself made in the mean time. Nothing is more difficult than to resume a former attitude of mind. Matters which appear perfectly commonplace to-day were eight years ago full of mystery to us. Hundreds of most capable men, both in the old world and the new, have been most earnestly at work on the subject of electric generation and distribution for these years, and yet we are assured that they have learned nothing of such importance as to make the difference between earning a dividend and making a loss, in a continuous current system.

In a manufacturing business—and an electric supply company is a purely manufacturing concern of the simplest possible kind—success depends chiefly on having no unproductive capital, and in keeping down working expenses. Now it is quite certain that for a given output both these items would have been greater in 1883 than at present. Dynamos were not only much more expensive then than now, but they were smaller, involving, a larger outlay for buildings and for foundations. The 3-wire system of distribution—an immense source of economy—was not brought out, and engineers had no information in the form of load diagrams to aid them in designing their plant. As to working expenses, they are still too high. Considering the absolute simplicity of the process carried on, the staff of an electric station is very large and expensive. But we should be sorry to think that very much has not been done since 1883 to simplify the management. We fear the shareholders in Mr. Crompton's station, had the plan been carried out, would have found their property more satisfactory from a scientific than from a financial point of view.

The writer in the *Times* did not quite accept Mr. Crompton's contradiction of his opinion, and last Friday a long letter was published from him, in which he returned to the attack. This is chiefly valuable in confirming the opinion that we formed from his previous communication that his views had a commercial rather than a technical basis. He makes the peculiar mistake of supposing that the percentage of loss of conversion of mechanical into electrical energy increases with the number of machines employed. He says: "As in the conversion of mechanical into electrical energy there must be of necessity a certain percentage of loss (5 per cent. or 30 per cent.—it is for the argument immaterial which) in every dynamo employed, it is obvious that the fewer the dynamos (consistent with the utilization of their full capacity and with the general efficiency of the whole plant) the less will be the totality of loss, and the more cheaply can electrical energy be generated and supplied." On the face of it this looks as if the writer meant that with machines of 90 per cent. efficiency there would be a loss of 10 per cent. in using one, 20 per cent. in using two, 30 per cent. for three, and so on. Probably, however, what he intended to convey was that large engines and dynamos are more economical than small ones. There is abroad quite an exaggerated opinion as to the relative economy of large and small engines and dynamos. It is quite true that very small machines have never a high efficiency, but a point is soon reached beyond which improvement is nearly imperceptible. It is possible to make an engine indicating 200-horse power as efficient as one many times its size, while a 500-horse power engine probably gives a better return for the money it costs to buy and work than any other size. Of course, in the happy future, of which the electric engineer dreams, when everybody will use his light, 500-horse power will be far too small a unit to employ in central stations. The size of the engine must be chosen in relation to the total amount of work to be done. Two engines will always be more trouble to manage than one, although they may not require more coal.

In denying that the pause in electric lighting arose from lack of knowledge, Mr. Crompton expressly excluded all reference to alternate current systems. These had no existence in 1882. Now they are in the front, and are exciting the deepest interest. Every one is watching the Lauffen-Frankfort experiments of the transmission of power for 110 miles, and if it prove successful the alternate current machine will take a yet more important position. This has not much to do with the electric lighting of London at present, but it is full of possibilities for the future. It is quite certain that the plan of small stations placed comparatively near together is not the one that will be perpetuated; indeed, it is doubtful if any of the existing methods of lighting will survive the term of 42 years that the monopolies of the companies run for.

Different Forms of Carbons Used in Arc Lighting.

[A paper read by Mr. W. C. Warner, before the National Electric Light Association.]

In the period just preceding the introduction of the arc electric lighting commercially, experimenters and inventors had brought forward numerous plans, ideas and theories regarding the size, form and manner of using carbons, and in view of the fact that no reasonably cheap method of generating the electric current then existed, a surprising amount of attention was given to the subject, and the developments of the art shown by many publications, from no small part of our history of arc lighting.

It is not my purpose to dwell at length upon the history of carbons generally, but rather to touch lightly on some of the more notable forms known, at the time of which I am speaking, and then to pass on to a consideration of the utility and practical results obtained with the different forms of carbons in use at the present time, paying special attention to the matter of form and size as affecting the results.

The form of a cylinder or pencil it is noteworthy was that used by Sir Humphrey Davy, in his earliest experiments, and he even devised special holders or claims to retain the carbon pencils in alignment and and facilitate their adjustment with a view of maintaining a constant steady light.

Archereau subsequently adopted the pencil form of carbon and used it in his lamp now so justly considered as the first practical arc lamp; it does not appear, however, that he turned his attention particularly to to the matter of form.

Wright and others stand on record as experimenters with carbon discs, brought edge to edge, and made to rotate as they were consumed, and the combination of a disc placed on edge above a vertical pencil of carbon was also tried at this early date.

Wallace and Farmer made use of broad, flat plates of carbon, placed in a vertical plane, one above the other, the arc forming between the edges as they were drawn apart, and shifting back and forth from one end of the plates to the other. Another inventor, at about this same date, placed flat plates of carbon side by side with the arc forming at the upper edges of the plates, and an intervening insulation of some refractory material, the the arc forming at the upper edges of the plates and gradually consuming them.

Jablochkoff, in 1876, introduced his well known electric candle, a form of arc lamp, in which cylindrical carbons are employed, placed in a vertical position, and held separated by a thin filling of refractory insulating material.

Now, when we look back at the work of these early inventors, and consider what special object they had in mind in making their experiments, it is at once apparent that it was continuity of action, and it stands on record that they met with fair success so far as the feature is concerned, some of the lamps being capable of twenty hours burning without attention.

In 1874 Mathias Day produced an arc lamp in which two cylindrical pencils were placed in the upper holders and two in the lower holders; the upper ones occupying a plane with the lower and directly over them. Here the avowed object of the invention was to secure long continued operation of the light without requiring attention, and it is certain that he accomplished it in a very creditable and ingenious manner.

Coming now to the time of the commercial birth of arc electric lighting, we find Jablochkoff in the lead, closely followed by Brush and Wes-

ton, each making use of the cylindrical form of carbon pencil, and turning their attention most assiduously to the feature of continuity of operation, the first move being an increase in length of the pencils. Carre, a French manufacturer, at this time, became prominent as a maker of carbons, and succeeded in producing pencils about $7\frac{1}{16}$ inch diameter, and 32 inches in length, and it was thought by the use of lamps of suitable length, these long carbon pencils could be advantageously used when long continued burning was a necessity; but owing to the difficulties encountered in the manufacture, and also trouble in maintaining proper alignment for the carbons, a length of 22 inches was soon settled upon as most practicable and convenient.

As the business increased and the demands became better understood, the inventors again essayed to solve the problem of continuity of action, but in many cases such attempts were but returns to old forms and methods, and did not result in any practical advance.

Various forms of double carbon lamps were introduced, and for a time these were thought to be the only practical and commercially successful way out of the difficulty, but more recent developments have shown a far simpler and better way, and one, furthermore, that cannot fail to impress the practical electrical engineer. I refer to the simple expedient of using a carbon pencil of $\frac{3}{8}$-inch diameter 14 inches in length in an ordinary single carbon lamp. It is true that this is not new, and that carbon pencils of such size, or even greater, were tried long ago; nevertheless, the introduction of carbons of this size and form has a very great bearing on the commercial side of the situation; but before going into that matter I wish to say a few words regarding the lighting efficiency of $\frac{1}{2}$-inch carbons.

Having noticed that the question had been raised as to whether these carbons would give as much light for a given expenditure of electrical energy as would those of 1 inch diameter, I tried the following experiments:

Two single lamps were connected in series in an arc circuit, one being supplied with $\frac{1}{2}$ inch carbons 14 inches in length, the other with $\frac{1}{2}$ inch carbons 12 inches in length. Around each lamp was branched a voltmeter, indicating the voltage. The lamps were then adjusted until they had the same voltage, and as current was of necessity the same in each, it was a safe conclusion that equal amounts of energy were being supplied. Photometric comparison of the two lights was then made at the horizontal and at many different angles above and below, with the result that no perceptible difference could be found in the power of the lights. During the tests the current was maintained as constant as practicable, and care was taken to base the comparison on an average deduced from a large number of readings.

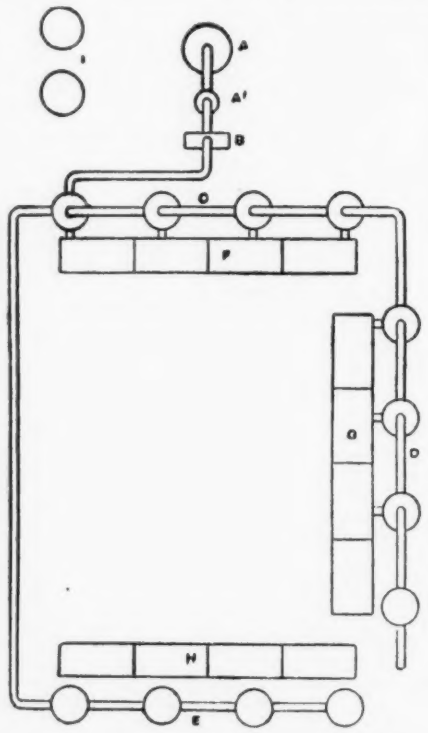
Now, while this matter of lighting efficiency is one that concerns the people operating electric plants, it does not interest them to the extent that other features upon which I have yet to touch may, as I happen to know that the management of lighting stations look long and lovingly on any plan that seems to give good promise of reducing running expenses. To begin with, there is the difference in first cost between a single and a double carbon lamp, and the difference in the expense for repairs and attendance; these items varying, of course, with the different lighting systems. Still another important saving is in the cost of carbons—the cost for a given number of hours run being fully 30 per cent. greater with $\frac{1}{2}$ inch than with $\frac{3}{8}$ inch carbons. There is the further important saving in the breakage of globes, which often is caused by the sudden shifting of the arc in the double carbon lamp. Twin carbons, consisting of two cylindrical pencils placed parallel and in close juxtaposition to each other, and connected by a web throughout their entire length, have of late been introduced, and when in use the arc alternates between the different pencils comprising the upper and lower twin carbons. A test of these carbons, made principally with a view of determining the life and lighting quality, gave unsatisfactory results in the following particulars: It was observed that the duration of burning for a given weight of material was not near equal to that which could be obtained with the same amount of material in a single cylindrical pencil. This I attribute to the more rapid disintegration of the twin carbon, resulting from the very frequent heating and cooling of each member. Indeed, this is found to be true of two carbons when arranged as in the Day lamp, or so that the arc alternates frequently between the different sets; and there is quite a noticeable difference in consumption of carbon for a given duration of lighting as compared with an ordinary single carbon of the same diameter burning without interruption.

Another undesirable feature of twin carbons is the shadow cast by the non-burning members, which, while it may not be disagreeably noticeable when the lamp is provided with an open globe, most certainly operates to reduce the total output of light.

It may be argued that the main item of expense in the manufacture of carbons does not lie in the material, and the fact that $\frac{1}{2}$ inch carbons cost so little more than $\frac{3}{8}$ inch would bear out such a position; and I have merely mentioned the fact of the rapid disintegration and burning away of the twin carbons by way of explanation.

The Simpson Alkali Process.

Industries calls attention to the erection, at Widnes, England, of research laboratories by the United Alkali Company as indication that the Company is fully aware that fresh changes may still be rung on the old Leblanc process. Mr. James Simpson, of Liverpool, has evolved one of these changes, and patented a new process, which combines the manufacture of carbonate of soda with that of concentrating the phosphate of lime minerals. No ammonia is required in the process, and no



tank waste is produced. The inventor, by amalgamating the manufacture of carbonate of soda and sulphate of lime with that of phosphate of lime of high strength, succeeds in obtaining these substances in a more economical manner than has ever been done hitherto. There are four distinct operations involved in the new process.

The ground phosphatic mineral, previously wasted, if it contains carbonate, is suspended in water, and a current of sulphureted hydrogen passed through the mixture. The free lime and that which existed as carbonate present in the mineral passes into solution as calcium sulphydrate, and the mineral has its weight reduced proportionately, and percentage of phosphate of lime in it thereby increased.

$$CaO + 2HS_2 = Ca(HS)_2 + H_2O.$$

After the solution of calcium sulphydrate is removed, the phosphate of lime can be dissolved by a mineral acid and separated from the silica and silicate of lime which it may still contain. The quantity of acid required for this operation is obviously far less than that required for the untreated slag. Hydrochloric acid of about 10° Tw. is used for this operation. The acid solution of nearly pure phosphate of lime obtained in this way is then neutralized by hydrate or sulphydrate of lime solution, and high strength phosphate of lime is precipitated. The calcium chloride liquors are run to waste, while if sulphydrate of lime is used for this operation the sulphureted hydrogen evolved is used for brimstone or vitriol manufacture.

The third operation consists in treating a solution of neutral salt cake, obtained in the ordinary way from salt and sulphuric acid as in the first part of the Leblanc process, with the calcium sulphydrate solution formed in the first operation. The reaction that then takes place may be thus represented, and is facilitated by conducting the operation under steam pressure of 60 lbs. to 70 lbs. per square inch:

$$Na_2SO_4 + Ca(HS)_2 = CaSO_4 + 2NaHS.$$

The sulphate of lime is thrown down in such a condition as to render it available for the manufacture of plaster of Paris or pearl hardening

for paper manufacture. It may also be utilized as gypsum for agricultural purposes. The solution of sodium sulphydrate is then heated in a series of Solvay's towers or other carbonating apparatus with carbonic acid gas until the bicarbonate is precipitated.

$$NaHS + CO_2 + HO_2 = NaHCO_3 + HS_2.$$

The sulphureted hydrogen evolved is employed for the treatment of a further quantity of the mineral or slag in its first operation. It will be noticed that theoretically there is no loss of sulphur involved in this process, but in practice it is found necessary to compensate for a small unavoidable loss by the addition of Leblanc alkali waste or reduced sulphate. The carbonic acid employed in the carbonating operation is produced by burning limestone in a lime kiln with coke, the gas being drawn from the soda towers, when sulphureted hydrogen is evolved at sufficient pressure to pass through the sulphydrate vessels, the nitrogen from the last vessel passing through the milk of lime scrubber and an oxide of iron bed to eliminate any trace of sulphur before it escapes in the air.

In the accompanying diagram *AA* represents the lime kiln and scrubber, and *B* a blowing engine. The lime kiln gases pass into the sulphydrate of sodium in the vessel *C*, the liquors run through the filter bed *F*, whilst the sulphureted hydrogen evolved is absorbed in the series of vessels *D* containing the ground mineral and water (the furnace *I* roasts the mineral if necessary). The liquors from *D* are filtered through the filter bed *G* from the insoluble phosphate, and is then mixed with the salt cake in the vessel *E*, filtered from the sulphate of lime by the filter bed *H*, and passes back into the carbonating vessels *C*.

The phosphate obtained by this process is practically pure tricalcic phosphate, containing 55 to 56 per cent. of phosphoric acid; and as the highest grade natural phosphates seldom exceed 83 per cent. of tricalcic phosphate, the product will be found much more advantageous for manure manufacture than anything at present in the market. The inventor believes that the profit resulting from the enrichment of the low grade phosphate is more than sufficient to pay the cost of the alkali. In other alkali processes the gross cost of the alkali is far greater than the returns from the recovered bye-products.

Analysis and Cost of Rose Fuel Gas.

The *American Manufacturer* furnishes the following figures respecting the showing made by the Rose fuel gas process at the works of the Bellefonte (Pa.) Iron and Steel Company, where the fuel is used for puddling purposes. The appended analyses figures, showing the composition of the gas, were deduced by Dr. E. G. Love, of this city:

	Per Cent.	
Hydrogen	44.67	
Marsh gas	14.50	
Carbonic oxide	15.35	
Heavy hydrocarbons	5.30	
Nitrogen	18.83	
Carbonic acid, etc	none	
Oxygen	1.35	
	100.00	
Calorific power at 60° F. and 30′		470.05 units.

The tests of the plant at Bellefonte were made for Messrs. Carnegie, Phipps & Co., by Mr. T. B. Lee, M.E., 91 Fifth avenue, Pittsburgh, who made a very careful running test of the producer to determine with accuracy the cost of the gas, whose report in substance is as follows:

Data of 12-Hour Test of Gas Producer Plant, August 17, 1891.

Started at 7:53 A.M and stopped at 7:56 P.M. Gas made in 12 hours 3 minutes		234,650 ft.
Oil used, 395 gallons, at 2¼ cents per gal.	$8.89	
Coal used, 2,464½ lbs., at $1.50 per ton..	1.72	
Coke used, 1,045½ lbs., at $2.25 per ton.	1.06	
Labor, two men, $1.75 and $1.50 per day	3.25	
Steam (from B. I. & N. Works, estimated)	.50	
Water " " " "	.25	
Total cost of gas	$15.67	
Cost per 1,000 ft. of gas, 6.68 cents.		

At the beginning of the test the chambers of the producer were full to the doors, and at the finish they were filled to the same point with the measured coal and coke, by which the exact amount of solid fuel consumed was determined. Each barrow of coal and coke was weighed as it was brought on the platform, and each barrel of oil was carefully measured. The gas tank was accurately gauged by meter, and lines marked on, between which 3,000 ft. were contained. This measure was filled and exhausted 86 times, and the total discounted 15 per cent. for possible contraction due to fall of temperature, making total production 234,650 ft. The producer made gas constantly for 12 hours and 3 minutes, with no waste at any point. The prices given in the tabulated data above included freight to Bellefonte, and were given by the clerk of the Bellefonte Iron and Nail Works.

In making a comparison of what the cost of this gas was at Bellefonte and what it would be in Pittsburgh, the following facts may be noted: First, Lima oil, which is a large factor, costs at Bellefonte 2¼ cents per gallon, while in Pittsburgh the Standard Oil Company will contract to furnish it for one year in any quantity at 1.41 cents per gallon, and have done so with at least one Pittsburgh firm. The item of coal would further reduce the cost here. Slack, which would fill all requirements, can be had here for $1 per ton at an outside figure, while at Bellefonte it was charged at $1.50. It is plain that the cost can easily be brought here to below 5 cents per 1,000 ft. It has been found that with regenerative puddling furnaces the consumption of gas does not exceed 20,000 ft. per ton of iron, bringing the cost of fuel for puddling to within the limits of $1 per ton.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

WEYMOUTH, Sept. 10, 1891.

Testing Coals.—Value of Gas Stocks and Shares.—Inclined Retorts.—A Metallic Gas, etc.—Mr. G. Livesey and the Quality of London Gas.

The Belgian Association of Gas Managers have adopted the plan of directing attention, at their usual monthly meetings, to one subject only. The committee select a matter of importance and general interest to the members, and name a member to write a paper on the subject, the same being read and discussed in the usual way. Assuming that all the members are so far interested in the objects of the Association as to attend the meetings and take part in the discussions, thus affording the committee an opportunity of judging the individual knowledge and experience of each one in respect to every detail of the gas engineering profession, such a plan seems to possess the advantage of drawing out the best and most authoritative information available in regard to the particular subject in view. But in England we have men who seem to be satisfied with paying their subscriptions and getting a volume of the transactions. They have a vague sort of idea that their name on the members' roll assists in supporting the Association, and if such was absolutely necessary would come forward rather than allow it to fall through for want of support. As it is, they rarely trouble to come to the meetings and the burden falls upon those who are willing to bear it. The voice of the individual belonging to the class just indicated may be quite unknown to his fellows. With a large number of such persons to deal with, the committee would be hampered in the proper allocation of subjects. But this is a matter that would right itself after a time, provided that every member accepted the fact that his obligations to the Association include taking part in the proceedings when requested to do so.

As an example of the class of subjects dealt with by the Belgian Gas Engineers, it may be mentioned that "the testing of coal" was the topic submitted at a recent meeting. A paper was read enumerating the present state of knowledge on this interesting question, and in the course of the subsequent discussion a great deal of stress was placed on the importance of publishing the fullest possible details of the tests obtained at different gas works. Perhaps on this point matters stand in Belgium in a similar position to that occupied by them here. All our largest class of gas undertakings employ competent chemists and provide suitable laboratories for the complete examination of the coals and all other materials used by them. But the results so obtained are considered to be the property of the company, taken for the use of the engineer, and there is a great reticence as to publishing. Many who would gladly place the same at the disposal of brother gas engineers would hesitate about scattering them before the public through the medium of a Gas Managers' Association. Some provincial newspapers, I am told, practice a system of "exchanges," and it has several times been suggested whether the Gas Managers' Association could not be made the means of circulating special information between the members, such as statistics and other things that concern themselves rather than the public generally. It will hardly be denied that a record of the practical results obtained at all the neighboring gas works would be a great help to any gas engineer.

So far as one may judge from the quotations of gas securities in the stock and share markets, the public confidence in the value of gas property is unabated, notwithstanding the increased price of coal, and the advance, both real and alleged, of the electric light. This is remarkable when we remember that some of the gas companies, during the last year or so, have had to look to the reserve fund for a large part of their dividends, and the general impression that coals will not fall to any important extent below their present rates. As to the electric light, it has been allowed sufficient rope and has, to a certain extent, hanged itself. Whilst the consumers are complaining loudly of the high prices charged, the electric light companies are not able to pay dividends and are not likely to do so at the present prices. These, by the way, are said by the well known Mr. W. H. Preece and such like enthusiasts, to be "30 per cent. dearer than gas;" but by consumers (who judge from the practical point of the account rendered), to be four times as much. Many of the first-class gas securities paid purchasers who are satisfied to get less than 4 per cent. on the money so invested, and the shares of any well conducted undertaking will be taken up for less than five per cent. For example, the latest quotations for debentures in the Commercial Gas Co. (London) show £3 12s. per cent. Some preference shares in the Continental Union have realized at £3 10s., and debentures in the Sou h Metropolitan, £3 9s. Several classes of the Gaslight and Coke Companies' capital fetch equally high prices.

A sub-committee of the Salford Corporation Gas Committee, who have visited several gas works where inclined retorts are in use, appear very favorably impressed with that system, and if the opinions formed by these gentlemen can be substantiated in practice, there is no doubt as to the rapid progress and adoption of this method of retort setting. Amongst other advantages claimed, there is a saving of 50 to 60 per cent. in labor, with less exposure to heat for the men and less dependence on personal skill, so that the plant could be worked just as well by inexperienced laborers as by workmen specially trained. These are solid advantages with some extra expenditure in the way of first cost, etc. For making gas on a small scale the cost of additional brickwork, building, elevating machinery, etc., is an important item, not to be undertaken until the success of the system has been absolutely proved by experience. An important feature of the system is the fact that it does away with the restrictions both as to length and section of retort that appear to be inseparable from the ordinary horizontal arrangement.

It has recently been shown that if pure carbonic oxide is passed over metallic iron in a state of very fine division and slightly warmed, chemical combustion ensues. The compound gas so obtained burns to a brilliant white luminous flame, and a metallic deposit of iron may be obtained by holding a cold porcelain surface in the flame. This deposit is soluble in hydrochloric acid, and the solution gives the reactions usual for iron. The iron used for the experiment must be perfectly free from oxide, and may be prepared by reducing dried precipitated ferric oxide, obtained by the ignition of ferrous oxalate in a current of pure hydrogen.

This new gas has been called iron carbonyl, and while not likely to be of use as a commercial illuminating gas, the fact that iron may be carried by a non-luminous gas just like heavy hydrocarbons, is of great interest, and will no doubt be turned to good purpose in the arts. While on scientific subjects, I may also direct attention to another important fact that has been observed, and that is the action of alkaline solutions upon the illuminants present in gas. It is a very common practice to estimate the carbonic acid in gas by absorption, agitating it with a solution of potash in a burette, or in a separate vessel, as on Hempel's system. In either case the result would be too high, as besides the carbonic acid, some of the hydrocarbons would be absorbed. Some years ago I found that the burette gave 0.5 to 1 per cent. more carbonic acid than that obtained by using a standard solution of baryta, and either titrating the solution or weighing the precipitate. Further, it is possible that careful experiments would show that but few of the absorption methods are strictly accurate. I have yet another scientific note that may be interesting. Dr. Mills and Mr. McMillan have been conducting a long series of experiments on destructive distillation, and they find that when coal is distilled at a high temperature about five-sixths of the total carbon present in the coal remains behind in the retort as coke. Of the sixth that is volatilized, one third goes to the tar well and the remainder to the gas. At a low temperature, nine tenths of the carbon are left behind, and the volatile part is equally divided between the tar and gas. So that at the high temperature, about twice as much carbon goes into the gas as at the low temperature. At the low temperature the yield of gas was 3,580 cu. ft. per ton, specific gravity 0.537; and at the high temperature 10,089 cu. ft., specific gravity 0.403.

Mr. Geo. Livesey, the Chairman of the South Metropolitan Gas Company, has addressed a letter to the London County Council on the subject of the arrangements at present in vogue for testing the London gas supply. He commences by directing attention to the fact that the competition of other illuminants renders the companies anxious to keep up the illuminating power of the gas, apart from the supervision exercised by the officers of the Council; whilst the sliding scale arrangements render the Company a direct interest in keeping down the price. After a glance at the difficulties under which the gas industries are at present laboring, he goes on to show that anything in the way of forcing the suppliers to raise the quality of their gas is not necessarily an advantage to the customer. On account of the high price of cannels and first-class gas coals, the increase in quality may necessitate a disproportionate increase of price. A large proportion of the gas supply is used for purposes other than lighting, and therefore the result may be dearer gas to the consumer, instead of cheaper. The officers of the Council have followed such a course by introducing "improvements" in the photometers used, and by making alterations in their ways of testing, etc, that have the effect of rendering it necessary for the companies to send out a gas of 1½ or 2 candles higher illuminating power than formerly, although the quality nominally remains the same. Under these circumstances Mr. Livesey thinks there is room for a better understanding on the subject, and that quite as much on behalf of the consumers as the shareholders.

Economies of Iron and Steel.

The London *Builder* says that such extensive use is now made of iron and steel for structural purposes, that a considerable knowledge not only of what can be manufactured and readily obtained, but also of the leading principles and practices of the industry is becoming more and more necessary to the engineer and architect who have to use these materials. A brief examination of the average specifications relating to iron and steel work is sufficient to show that much greater uniformity might be observed in the requirements of engineers regarding the quality of the material they demand for various purposes; and the designs for structural work in many cases exhibit so many different forms and sizes of rolled sections, that much delay and extra expense is caused by the difficulty of obtaining such from the manufacturers within a reasonable time.

Mr. H. J. Skelton, in his book on the "Economies of Iron and Steel," has attempted to make clear the best every-day practice in the heavy iron and steel trades, to those whose province it is to deal with the material after it is made." It is not therefore a book for the manufacturer, but for those who are responsible for the proper application of the materials. From the first page to the last the subject has been treated in a clear and workmanlike manner, and we know of no book that could be studied with greater advantage by those who use, or are interested in, the products of the iron and steel industry.

The work is naturally divided into three parts. "Cast iron," "wrought iron," and "steel." The manufacture of each, and the forms in which it can be obtained, are described, and the most approved tests which each material should stand to insure it being of a suitable quality for the purpose for which it is intended, are also given at some length, and form a useful portion of the book. Since it is now possible by the "basic" process to utilize phosphoric pig iron, nearly one-half of the crude iron produced in Great Britain is converted into steel, and excellent material can now be made from metal taken direct from the blast furnace to the Bessemer converter. Of the pig iron now made only a small quantity is produced by what is known as the "cold blast," as the greatly increased price of material made in this way prevents its being used except where its superior quality renders it necessary.

The ordinary test for cast iron which is to be used for structural purposes is, that a specimen bar of the material 2 in. deep, 1 in. wide, and 3 ft. 6 in long, placed on bearings 3 ft. apart, should withstand a load of from 25 cwt. to 30 cwt. applied at its center, before breaking. Such a test however does not insure the metal being sufficiently ductile for many uses, and we quite agree with the author, that better cast iron is secured if it is specified that the above test bar must deflect not less than from ¼ in. to ⅜ in. before fracture. Specimen bars should also be tested that have a thickness equal to the thickest part of the casting, the quality of which they are intended to exhibit.

In dealing with wrought iron the author first describes what is known as "best Yorkshire," which is the best possible iron that can be obtained, being made from a superior quality of cold blast pig iron, and a fuel practically free from sulphur. Lowmoor and Bowling iron are examples of best Yorkshire iron, but there are other brands which denote qualities of equal excellence. Material of this class is used in the boi-

ers of locomotives and other engines, in the couplings used on railways, and generally where sudden stress may be expected, and when any failure might be attended with disastrous consequences. Other qualities of iron are made in Staffordshire, Shropshire and other counties, but it is wiser to specify the tests that the material will be required to stand, than to name the locality from which it is to be procured.

In dealing with the tests for wrought iron, the author lays great stress upon the necessity of specifying what amount the reduction of area at the point of fracture of the test piece should be, as well as what elongation is required, in addition to tensional strength, and he also points out that the appearance of the fracture of a piece of iron must not be taken as too sure a guide to its quality, since it is quite possible to make a bar of excellent material show a crystalline fracture, due entirely to the manner in which it has been broken.

One-half of the book has been devoted to a description of steel, and the Bessemer and open hearth processes, in which pure pig iron is used, are explained, as well as the "basic" method, which permits phosphoric pig being utilized. To the uninitiated the distinction between wrought iron and steel is not very evident when the chemical constitution is alone considered; but when it is remembered that wrought iron is produced by welding together a number of small pieces, which have never been thoroughly fused, while mild steel has been completely melted before being cast into ingots, the difference between the two materials is easily realized.

In dealing with mild steel greater care must be exercised than is necessary in the case of wrought iron. As stated by the author, all sheared edges of plates should be afterward planed, and all holes should be drilled. In some cases, however, when the thickness of the material does not exceed three-eighths of an inch, we think punching might be allowed, although it should never be permitted in thick plates. In designing structures in iron and steel it must not be forgotten that while the cost of the steel may be somewhat greater than that of iron, and that extra expense is incurred through the more careful treatment necessary in the workshop, yet these outlays may be more than counterbalanced by the reduction that may be effected in the weight of the structure, owing to the increased stress per square inch that is allowable, as well as by the much larger sizes of the plates and rolled sections that can be obtained in steel.

It is essential, when specifying the quality of steel required for structural work, not only to state the least strength per square inch that the material must have, but to require also that its strength shall not exceed a certain limit. The range allowed between this maximum and minimum strength is generally from 3 to 5 tons.

The author adds considerably to the value of his work by giving a comprehensive list of those tests which are at the present day recognized as the best that can be applied to steel to secure a quality that is suitable for the purpose for which it is to be used, and he also gives many useful tables showing the sizes of rolled sections and plates that can be ordinarily obtained, and the extra price it is necessary to pay if these limits are exceeded.

In conclusion, we have confidence in recommending this work to engineers and architects, who will find it contains much that will be useful in everyday practice, as well as being a book which gives a clear and able description of the modern iron and steel industry.

Coal Raised from Deep Mines.

The question of the depth at which coal may be worked is of increasing importance to England, and it has received a practical answer in one of the recent reports of the inspector of mines. The report of Mr. Robson, the inspector for the important South Wales district, contains a table showing the output of coal from different depths in that district, in the past year. No fewer than 163 mines in that great district produce coal from a depth of not less than 100 feet out a total of 357 mines in the district. But though this was much more than a third of the total number of mines, yet the output was only about one-eighth of the total yield of the district. It is not until we come to a depth exceeding 600 feet that we arrive at the mines of large output in South Wales. Fifteen mines above that depth and less than 700 feet each yield on the average 110,000 tons each; then of a still greater class, five mines of between 1,100 feet and 1,200 feet in depth, yield each over 200,000 tons. Twelve each of 100 feet deeper class yield 214,000 tons each, and four of the deepest mines are amongst the most productive. These mines vary from between 1,600 feet and 1,700 feet to between 2,100 and 2,200 feet each, and the four are grouped together in the return, the total output being 1,371,581 tons, or an average of over 318,000 tons each. This report of the inspector is one that is most valuable, and whilst it is so given that the output of an individual colliery cannot be learned by the reader, it yet enables an idea to be formed of the depths at which coal is being wrought in the great district to which it refers. Roughly speaking, it would appear that less than one-half of the coal that is raised in South Wales is from a depth of over 1,000 feet; whilst about a twelfth part of the total is raised from the depth of over 1,500 feet. It is quite evident, then, that there is now a very deep working of coal—deep to what used to be the case—in South Wales. But there is still nearly a third of the total output raised from mines with a depth of 500 feet or less; and the mines between that and 1,000 feet are about as productive, so that the yield is from mines of very varying depth. It would be well if we could have similar tables in future years from the other coal-producing districts of the United Kingdom, for valuable data might be drawn from a comparison. It would be unwise to draw deductions from the isolated facts as to one district; but if we had the returns for the whole of the country, conclusions might be more safely drawn as to the relative safety of mines worked at different depths. This is a subject that has been discussed at different times, and the extent of the yield at varying depths would certainly be one of the factors that need to be taken into account before any trustworthy conclusion can be come to on that most important matter.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Pulaski Gas Light Company, of Little Rock, Ark., have applied to the City Council for an extension of the exclusive franchise to furnish gas in that city for a further period of 25 years. In return for the concession they agree not to charge in excess of $2.50 per 1,000 cubic feet for gas sold to the residents. The application was referred to the Ordinance Committee.

AT a recent meeting of the Street Commissioners of Saratoga Springs the matter of reducing expenses for lighting the village was taken up. Messrs. Pond and Wells, who had been instructed to look into the question, reported that 71 arc lights could be cut off, these to be replaced with 84 gas and 3 naphtha lamps. The report was adopted.

THE proprietors of the Nashville (Tenn.) Gas Company have notified the consumers that hereafter the gross rate for illuminating purposes is to rule at $1.60 per 1,000 cubic feet, all gas used for cooking, heating and power purposes to be billed at $1.45 per 1,000. On all classes of consumption a rebate of 10 cents per 1,000 is allowed if accounts are settled 5 days after the bills are presented.

THE Council Committee on Lights, Wheeling, W. Va., has reported in favor of supplying gas to the St. Alphonsus Orphan Asylum free of charge.

THE Lynn (Mass.) *Item* reports that an interesting question involving the right of gas and electric light companies to erect and maintain poles in the streets of cities and towns of Massachusetts is before the State Supreme Court, a suit having been begun by the Attorney General at the relation of the Gas and Electric Light Commissioners against the Walworth Light and Power Company. In 1887 the Legislature passed the act providing that where in a city or town a gas or electric light company existed no other company should be allowed to erect or maintain poles without first obtaining permission of the aldermen or selectmen. The defendant was chartered in 1888, and soon afterward put up poles and wires and began to do business in Boston. After a time the Company applied to the Board of Aldermen of Boston for leave to erect poles, and the petition was denied; whereupon an appeal was taken to the Board of Gas and Electric Light Commissioners, who sustained the Aldermen. Some of the defendant's competitors complained to the Commissioners, and the latter served notice that its poles and wires must be taken down. As the order was not complied with, an information was brought with the result that Attorney General Travis appeared before Judge Morton on behalf of the Commissioners. The Walworth Company contends that the act is unconstitutional.

THE Wilmington (Del.) City Electric Light Company has, in a complaint to the Board of Street and Sewer Directors, called attention to the great loss sustained by the Company in the wilful destruction of the incandescent lamps maintained by it in the public lighting of the city. The value of the property destroyed so far amounts to several hundred dollars. The Board replied that a standing reward for the arrest and conviction of persons found interfering with the public lamps was offered, and the Company has appealed to the Police Department to keep a vigilant lookout for offenders of the type noted.

THE St. Catharines Water Works Company, of St. Catharines, Canada, is suing the St. Catharines and Welland Canal Gas Light Company for arrears of water rates, amounting in value to $5,983.

THE Committee on Lamps of the Cambridge (Mass.) Council has been authorized to renew the contract with the Cambridge Gas Light Company for 300 or more gas lamps, for a term of three years, at the rate of $1.20 per 1,000 cubic feet, which is 15 cents per 1,000 cheaper than the supply under the former contract.

DR. N. H. SCHILLING has handed in his resignation as Manager of the Munich gas works, his health being such that absolute rest is enforced upon him by his physicians. Dr. Schilling has been in the service of the Munich gas works close on to one-third of a century. His place will be taken by Herr Lothar Diehl and Dr. Eugene Schilling.

WE regret to announce the death of Mr. Amos J. Bicknell, publisher of the *Architectural and Building Monthly*, at his home in Elizabeth, N. J., on the morning of September 21st. Deceased was born at Webster, Mass., in 1839, and located in Elizabeth in 1871, where he was much esteemed. He was one of the Vice-Presidents of the Elizabeth Board of Trade.

THE total quantity of kerosene imported into Bombay, India, in 1889–90 was 13,074,072 gallons, against 11,930,739 gallons in 1888–89. Of this amount 10,742,344 gallons were shipped from Batoum, Russia, while only 2,961,728 gallons were imported from the United States, or, respectively, 77 and 23 per cent. Four years ago, only 1,481,232, gallons came from Russia, and 5,871,581 gallons from the United States, or, respectively, 20 and 80 per cent.; so that in four years the positions of the United States and Russia in the Indian oil trade have been practically reversed.

WE are indebted to Mr. Magnus Ohren, Secretary of the Crystal Palace District Gas Company, of London, England, for a copy of the Directors report of the workings of the Company for the half year ended June 30th, 1891. The showing on earnings account is not so favorable as the proprietors could wish, but the decrease in net profit is chargeable mainly to the increased price paid for coal, abetted by the higher wages received by the laborers. The sendout for the 6 months compared with the corresponding half of 1890 shows a gain for the former of 12.87 per cent., the last quarter, however, averaging but 9.67 per cent.

"OBSERVER," writing under date of September 19th, forwards the following clipping, which explains itself. "The special committee appointed by the Mayor of Haverhill, Mass., to investigate the practicability and advisabilty of the city's establishing a municipal lighting plant has made its report. In order to arrive at a reliable and intelligent conclusion the committee investigated the matter at great length and examined a large mass of facts and figures bearing upon the subject. It has been in communication with many cities and towns, some owning their electric plants and others lighted by private parties under contract. As the result of these investigations the following facts are presented by the committee, which will prove of general interest to the towns and cities that contemplate taking advantage of the provisions of the act passed by the last legislature relative to the establishing of such plants by Massachusetts municipalities. The average price paid in 62 cities to private parties is $105.13 per light per annum and the same services performed by and directly under municipal control in 14 cities costs $55.12 per light. The first and only conclusion to be drawn from a study of these figures is that cities can furnish their own electric lighting more cheaply and advantageously than it can be procured from private parties. Using the figures given by 80 cities and towns throughout the United States, where the population is 10,000 and upwards, we find the maximum cost per annum per light to be $401.50, the minimum cost per annum per light to be $44, and the average cost per annum per light to be $103.20. These prices are for arc lights of 2,000-candle power, the same as in use at Haverhill. Our city is now paying $154.31 per light per annum, at the present time a sum more than 30 per cent. in excess of the average cost per annum, as given above. The committee gives the following estimate in detail of the cost of an electric light plant for the city of Haverhill: Installation of an arc light plant, as per specifications submitted, $9,969; fixtures and machinery, for incandescent lighting of city hall, etc., $2,690; steam plant, boiler, engine, etc., to include a 150-horse power compound condensing engine, $8,849; 40 mast arms, at $34 each, $1,360; sundry expenses for location of building, etc., $6,175.50; cost of building, boiler room, chimney, etc., $3,500; for contingent expenses, $1,700—total, $35,035.50. The cost of operating above plant would be 5 per cent. interest on $35,000 capital invested, $1,750; 5 per cent. per annum for depreciation and repairs, $1,750; 300 tons of coal, at $5.50 per ton, $1,650; salary of engineer, $900; ditto, of fireman, $600; ditto of trimmer, $600; of helper, $400; supplies, $300—total expenses per annum, $8,000. The figures submitted are from actual estimates, and as the committee is confident that the entire plant can be built and put into good running order for the sum named, it recommends the city to engage at once in the work of construction."

THE Franklin (N. H.) Gas and Electric Light Company has been authorized to light the streets of that town, for a 5-year period, by means of arc lamps.

ALDERMAN MCGOVERN, of Hartford, Conn., recently introduced a resolution in the Board directing the Mayor to designate the times and places when gas inspections shall be made, instead of the practice hitherto followed. He urged the passage of the resolution on the ground that the "gas was now so good that regular inspections were not necessary." Ald. Preston moved to indefinitely postpone the resolution, which was defeated, and the resolution was adopted.

AT the annual meeting of the Worcester (Mass.) Gas Light Company a good representation of the shares is reported. The reports of the President and Treasurer showed a satisfactory increase in business for the year. New consumers, to the number of 400, were taken on, and about 200 gas-stoves were placed. The improvements on plant consisted in the construction of a water gas annex, with the necessary station meter, relief holder, etc.; a stack of new benches was placed in the retort house, and three miles of street mains were laid. The Directors chosen were: Charles D. Lamson, A. George Bullock, Joseph E. Davis, Waldo Lincoln, Josiah H. Clarke, Francis H. Dewey and Joseph Sargent. The Directors subsequently effected the following permanent organization: President, Charles D. Lamson; Clerk and Treasurer, James P. Hamilton.

THE authorities of Wilmington, Del., have awarded a contract to the local Gas Company for the lighting of 900 or more gas lamps, on city lighting account, at the rate of $16.62 per lamp, the contract to last for five years.

THE plant and stock of the Van Wie Gas Stove Company, at Rockford, Ills., are in the custody of the sheriff, on account of judgments confessed.

FRED. BREDEL reports a very busy season, his contracts on hand amounting to many thousands of dollars.

PITTSBURGH, Pa., is now agitating the matter of engaging in the business of electric lighting supply on municipal account, and this intent is all the more surprising when one remembers that the adjoining borough of Allegheny City now complains that the electric lighting plant installed on municipal account is anything but up to the expectations of its promoters.

SEALED proposals for the piping for gas supply and the wiring for electric lighting service for the new buildings now underway at San Bernardino, Cal., which are to give shelter to the unfortunates committed to the care of the Trustees of the Southern California State Asylum for the Insane and Inebriates, will be received, up to noon of October 12th, at the Farmers Exchange Bank Building, San Francisco, Cal.

THE death of the Hon. W. L. Scott, which event had been feared for some months, occurred at midnight, September 20th, at Newport, R. I., where he had gone some weeks before at the advice of his physicians. The direct cause of Mr. Scott's death was heart failure, superinduced, no doubt, by the gastric troubles from which he had long been a sufferer. Owing to Mr. Scott's prominence in the gas industry, as proprietor of one of the greatest gas coal collieries in the world—the Ocean Mines—the following particulars respecting his eventful career will be read with interest. Premising these with the remark that we are indebted largely to Mr. James D. Perkins, of this city—who has for years, with his associates, represented Mr. Scott's gas coal properties—for our compilation, we find that "William Lawrence Scott was born in Washington, D. C., on July 2, 1828. His father had been graduated at the West Point Military Academy, and at that time was an officer of the regular army stationed at Washington. The grandfather of William L. Scott was Gustavus Scott, a native of Prince William county, Va., who died at Washington, D. C., in 1801. The father of Gustavus was the Reverend James Scott, a Scotchman, who became a minister of the Church of England, and accepted a living in the province of Virginia, about 1730. Gustavus Scott was educated at Kings College, Aberdeen, became a lawyer

and practiced in Somerset county, Md. He was a man of marked ability and much influence in affairs associated with the war for American independence. From him William Scott, it may be assumed, inherited many of those aggressive qualities which have given him prominence in the world of trade and politics. His father was of delicate physique and died when the subject of this sketch was a stripling, leaving the mother far from well provided with means. In fact, she was obliged to struggle for an existence for herself and small family. She was a woman, however, of much courage, with the responsibilities of her position fully appreciated. Even as a boy Mr. Scott was active and shrewd, and at 12 years of age he secured an appointment as page in the House of Representatives, where he continued to serve for six years. Meanwhile he availed himself of meagre common school facilities which the city of Washington then afforded. He cared little, however, for books, preferring the larger excitement associated with business affairs. While serving as a page he attracted the attention of the representative in Congress from the Erie (Pa.) district, Charles M. Reed, a merchant who was largely interested in the rapidly developing commerce of the great lakes. As a result, in 1848 young Scott removed to Erie, where he became a clerk in the office of his friend and patron. It was a propitious beginning for a youth of Mr. Scott's business tastes and talents, which were conspicuously in the direction of trade. He was methodical by instinct, and his judgment was rarely at fault. Two years had barely elapsed before he was launched in business undertakings on his own account. In these days there were many settlements along the line of the old Pittsburgh and Erie Canal, and Mr. Scott determined to supply them with salt fish. The white fish caught in the upper lakes he could transport at small cost to Erie, where they would meet salt brought from Buffalo at small cost. Thus he began the work of packing and selling fish, and he made frequent excursions into western Pennsylvania and along the canal. Soon, however, he turned his attention to trading in coal for shipment over the lakes, and in a short while he became a vessel owner and engaged in inland commerce. Along about this time the rapid development of the gas industry in the West and South brought about a demand for rich gas coals, and Mr. Scott was fortunate in his selection of a staple coal for shipment, and his gas coals were soon known along the settlements, rapidly growing into huge cities, located on the Western and Southwestern waterways. It was a natural sequence that he should become interested in other ways of transportation, and his capital found its way into other means of transporting his coals than over the changing beds of rivers. About 1879 Mr. Scott purchased at auction the mining property on the Youghiogheny river which had been spasmodically operated by Mr. Thomas Moore, his original purpose having been to utilize the product of this colliery (the coals from which were recognized in the trade as of high grade for gas making purposes) for his general lake supply. In 1880, however, through an adept and well planned scheme of water and rail highway, this coal first made its appearance upon the Eastern markets in what may be considered large quantities, and since that entrance the Ocean Mines Youghiogheny coal has figured as a very important factor in the Eastern gas coal trade of the United States, the annual shipments East ranging from 150,000 to 200,000 tons. Subsequent to the purchase of the Moore property Mr. Scott added largely thereto by the purchase of additional coal areas. In 1883 Mr. Scott organized the Youghiogheny River Coal Company, and transferred the operation of the Ocean Mine to that corporation. He was chosen President of the Company, with Mr. M. H. Taylor for Vice-President. The coal area of this Company is the largest on the Youghiogheny, comprising something over 4,000 acres. It might not be out of place here to say that the death of Mr. Scott will not interfere with the ordinary working of the Company. His determination to increase his railroad interests no doubt received great impetus from his marriage to a daughter of Mr. John B. Tracy, at one time President of the Chicago and Northwestern Railway Company, inasmuch as on the death of Mr. Tracy he became one of the executors of the estate. In his early railway experience he attracted the attention of Commodore Vanderbilt, and under the speculative influence always associated with that name he became a factor in Wall street, often being intrusted with the most important commissions in the manipulation of the market. He was a faithful disciple of his patron, and imbibed much of his spirit. He was always fond of repeating some word of advice given to him on many occasions by the old Commodore. They were these: 'Bill, don't you have nothing to do with them fellows that are always a takin' something up and never putting anything down.' Mr. Scott assiduously observed this item of advice throughout his life. At the breaking out of the war of the Rebellion Mr. Scott, though an ardent Democrat, with strong Southern sympathies, believed in the perpetuation of the union of the States as a nation. His position is best set forth in his own words: 'I believed I could be of more service to the Government by staying at home, so I organized the Scott Battery at an expense of $30,000. It was my idea that they could do much more good than I could as a private, or as a flinger of the sword of an officer, and so I let them go as my representatives.' In 1884 Mr. Scott was the Democratic candidate in the Pennsylvania district, comprising Erie, Venango and Warren counties. He was elected by a majority of 1,600 over the Republican, a Mr. Mackay, and was re-elected in 1886 over the same competitor. During his Congressional term he introduced a bill which provided for silver coinage to the limit of $20,000,000 per annum; also the bill levying a tax upon the manufacture of oleomargarine, which latter bill, with some modifications, became a law. He was a staunch supporter of ex-President Cleveland, and it is held by many that he was the one who inspired Mr. Cleveland to prepare his celebrated message on tariff reform. Some years ago he took an active interest in the breeding of racehorses, and his magnificent breeding and training farm at Cape Charles, Va., was the talk and wonder of the racing world. As with everything else that he undertook Mr. Scott attained eminence in his racing enterprises, the richest prizes of the turf falling to his share. The many victories won under his colors include the Futurity, Foam, Juvenile, Lorillard and other stakes, and amongst his contemporaries in the racing world—Messrs. Lorillard, Barnes, the late August Belmont, etc.—none stood more prominently for the honor of the turf than he. Mr. Scott was one of the most charitable men that ever lived, and always made every possible concession to the demands of labor, whose representatives he employed by thousands; and underneath his gruff manner pulsed a heart that was loyal unto the remembrance of the days when he felt the stings that poverty can bring. His wife and two daughters survive. The funeral services were celebrated on Thursday last, at his late home in Erie, Pa., amid circumstances and surroundings at once convincing that multi-millionaires may live in the hearts of their workmen as well as in the remembrance of their monied equals."

THE International Self-Closing Gas Burner Company has been incorporated, at Milwaukee, Wis., by Messrs. Charles Keeney, Isidor Leiser and C. K. Pier. It is capitalized in $100,000.

WE had a visit the other day from Mr. Stein "late of Philadelphia, but now of Waukegan, Ills.," and he is just as handsome and jolly as ever. The starch factory at Waukegan is completed, and only waiting for corn to come down to a figure "within reach" to start up. Judging, in the mean time, from fate that overtook the firm of S. V. White & Co., of this city, in their recent attempt to "bull" corn, we imagine that Mr. Stein's Waukegan factory will soon be grinding the golden grains.

THE Southern Gas Trust and Construction Company, which is presumed to have a large interest in the operation of the Palatka Gas Light and Fuel Company and the Ganesville Gas and Electric Light Company, both of Florida, has gone into the hands of a receiver. The Trust Company's headquarters were at Jacksonville, Fla.

THE residents of Pontiac, Mich., at a special election held on the 25th inst., agreed to authorize an issue of $14,000 in bonds, the proceeds thereof to be devoted to the installation of an electric lighting plant to be operated on municipal account.

THE 150-feet masts carrying arc lamps of a rated 4,000-candle power have been voted a failure at San Francisco. At least it would seem so from the action recently taken at a session of the Committee on Street Lights when, on motion of Mr. Tabor, it was agreed to report in favor of removing 8 of the 150 feet masts and to distribute the nominal illumination of the 4,000-candle lamps carried thereon at suitably located points. Masts 40 feet in height will be employed.

ACCORDING to the Boston *Advertiser*, a "well-known French electrician has invented a stove heated by gas or coke, which at the same time generates a thermo-electric current sufficient to charge an accumulator of 16 cells and feed a number of 10-candle power electric lamps. The electro-motive force of the current it yields is 35 volts, and the useful energy about 44 watts. The stove's peculiarity is that the wall is composed of 700 thermo-electric pairs, the hot joints being inward and exposed to the hot gases of the interior, while the cold joints are outward and provided with vertical flanges which help to cool them. Each pair consists of an alloy of antimony and zinc and a plate of nickel or white iron. The current is collected by similar wires and the fumes escape by a chimney."

The Market for Gas Securities.

Yesterday 100 shares of Consolidated gas were reported sold on the Exchange at 98½, and yet we know of a broker who has had an order for the past three days to buy the shares at 99, and he cannot get the stock. To-day (Friday) the bid rate was 98½, offered at 99½. There is no change in other city shares. Over in Brooklyn the situation remains unchanged, the managers of the Companies having determined to settle the question of future dividend rates when they have secured certain knowledge as to what earnings are to be under the reduced, or $1.25 per 1,000 schedule. Citizens gas is stronger, but the other shares are weak and halting. The *Eagle* some days ago, in its financial column, printed a statement reflecting on the credit of the Equity Gas Company that one would think the owners of the Company ought to speedily deny. We note a sale at auction of 60 shares Fulton-Municipal, at 113¼. Chicago gas shared the fluctuations of the excited market of the past 10 days. It opened to day at 51½ to ¾.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 Wall St., New York City.

September 28.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	98½	99½
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	119	121
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	119	121
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	95	98
Citizens	1,200,000	20	80	—
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	113	115
" Bonds	300,000		100	105
Peoples	1,000,000	10	60	63
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	90	92
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	125	130
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	100	105
" Bonds	1,000,000	—	105	109

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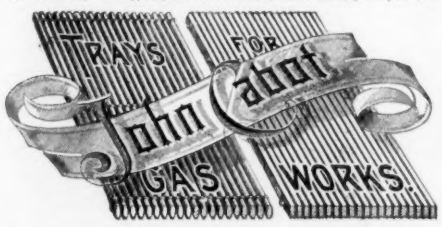

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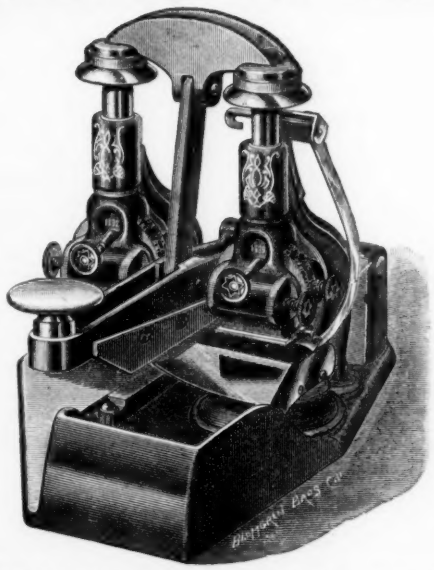

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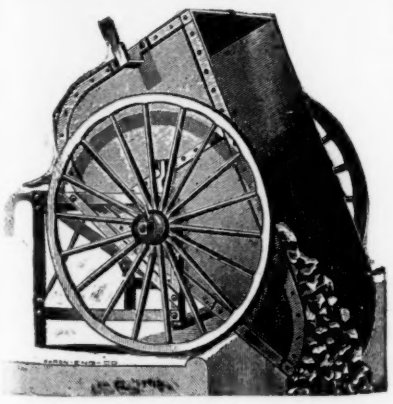

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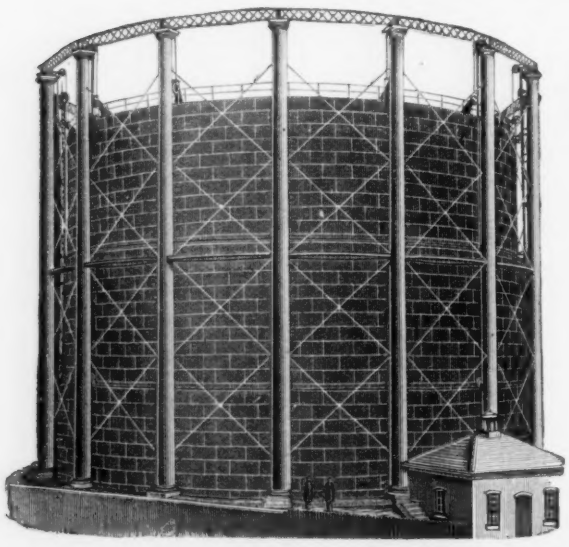

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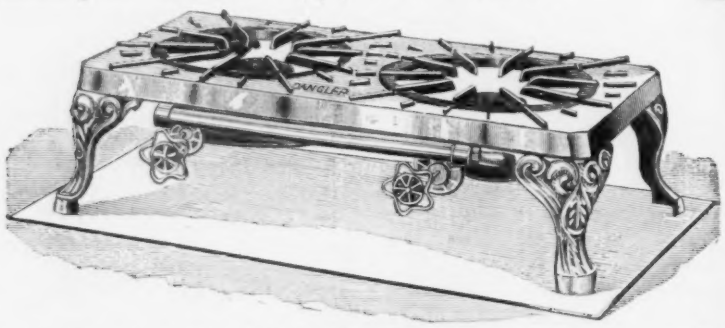

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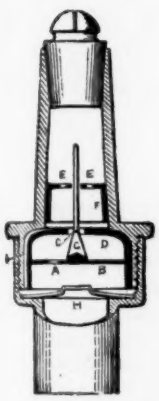

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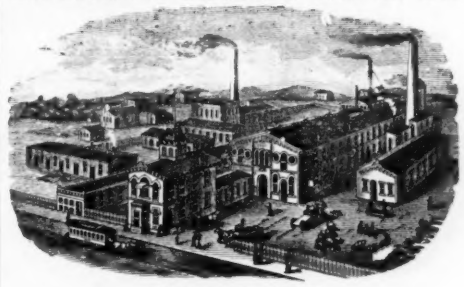

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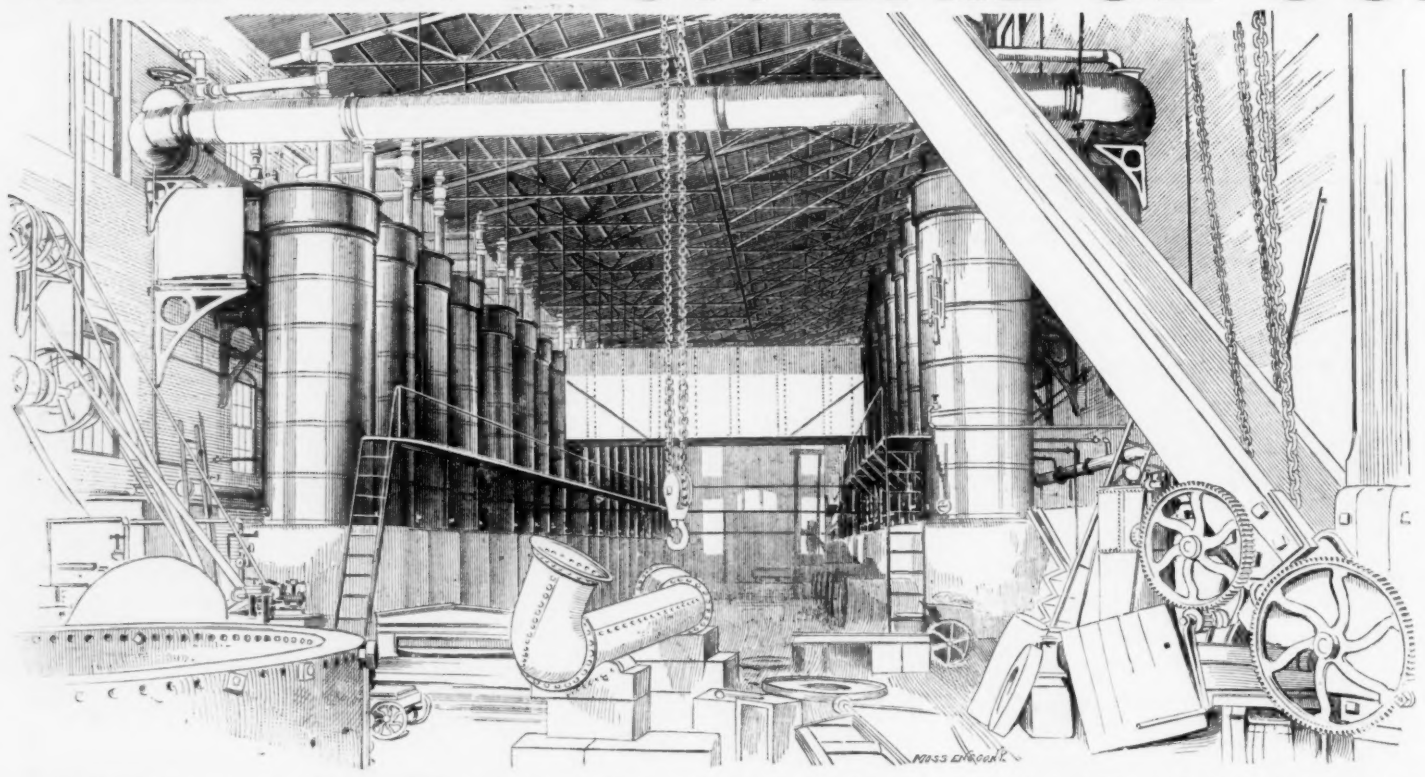

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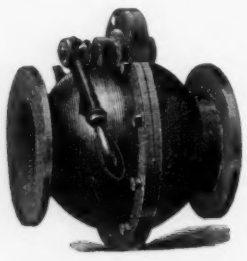

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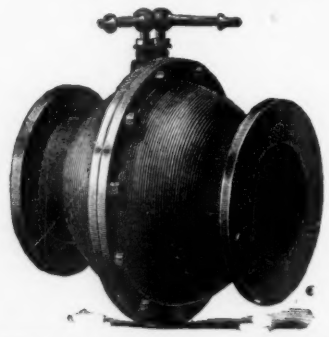

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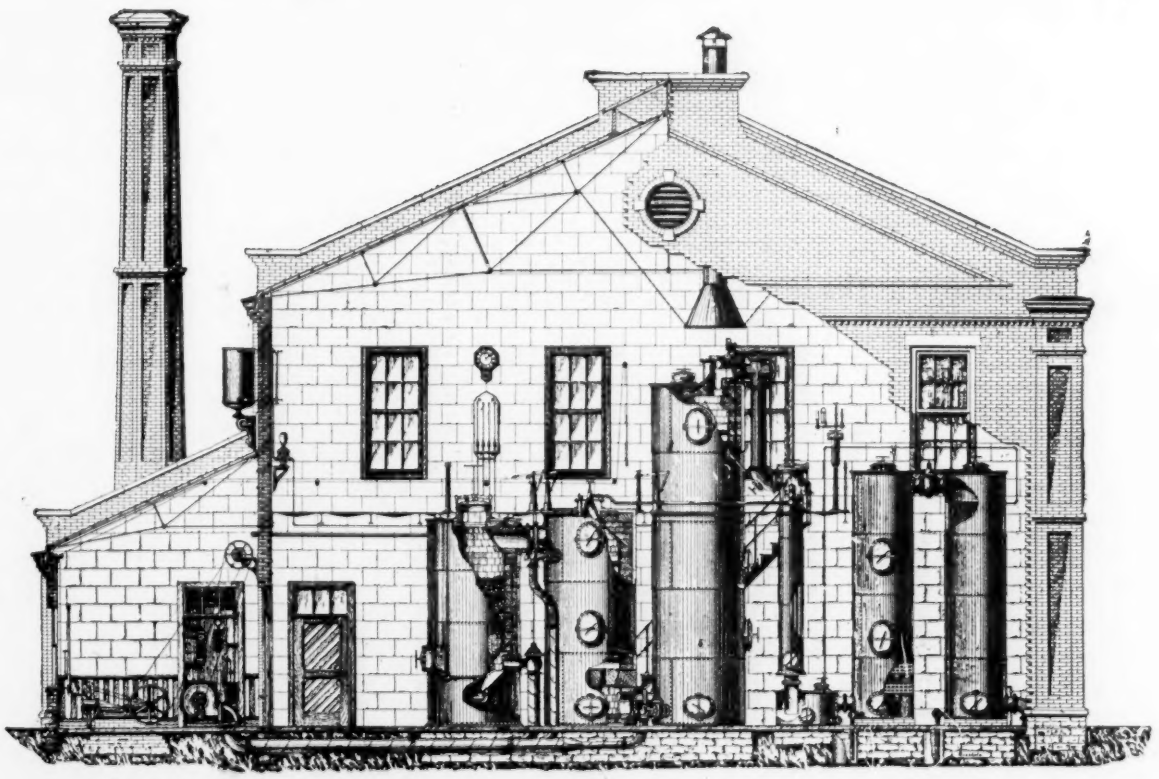

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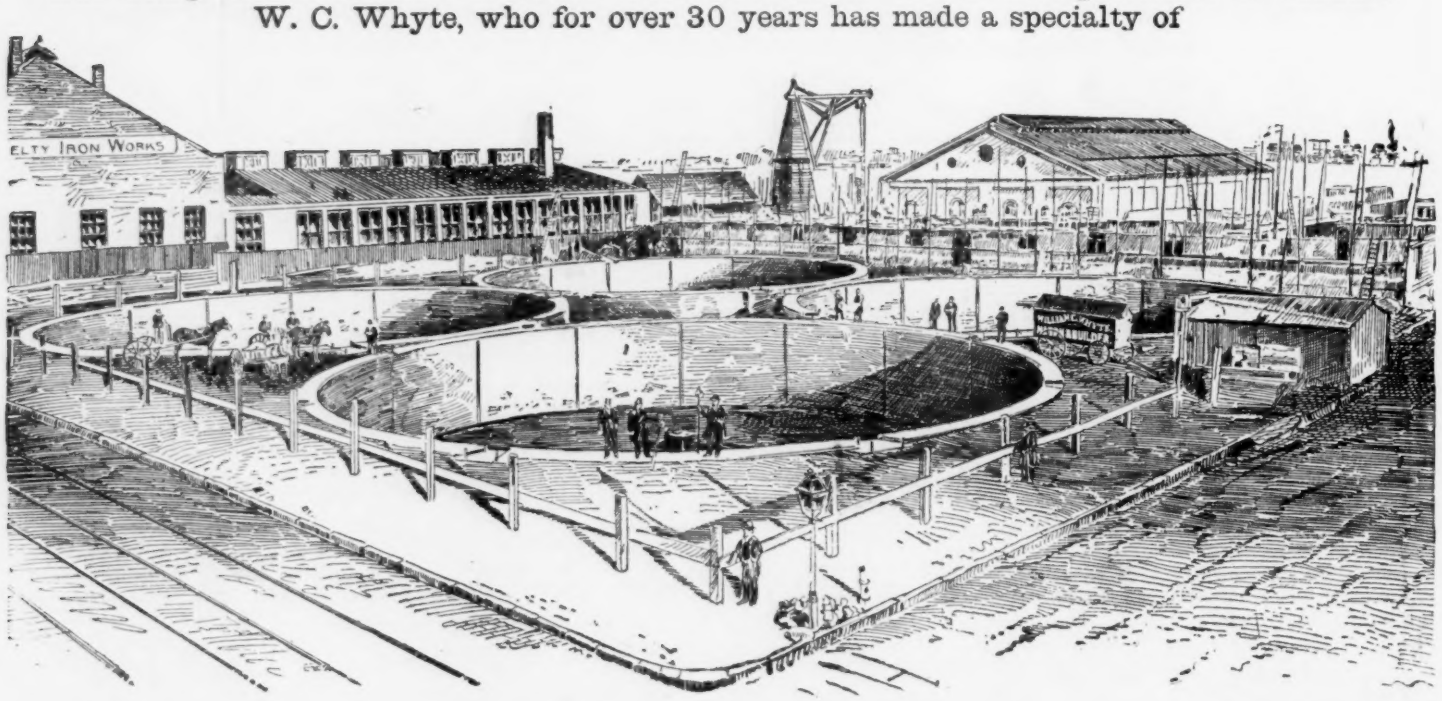

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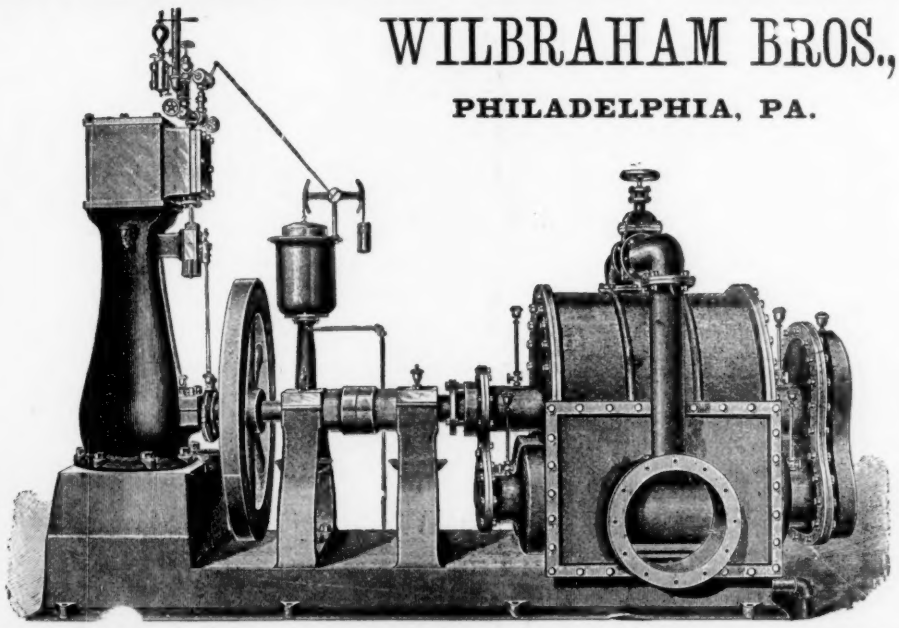

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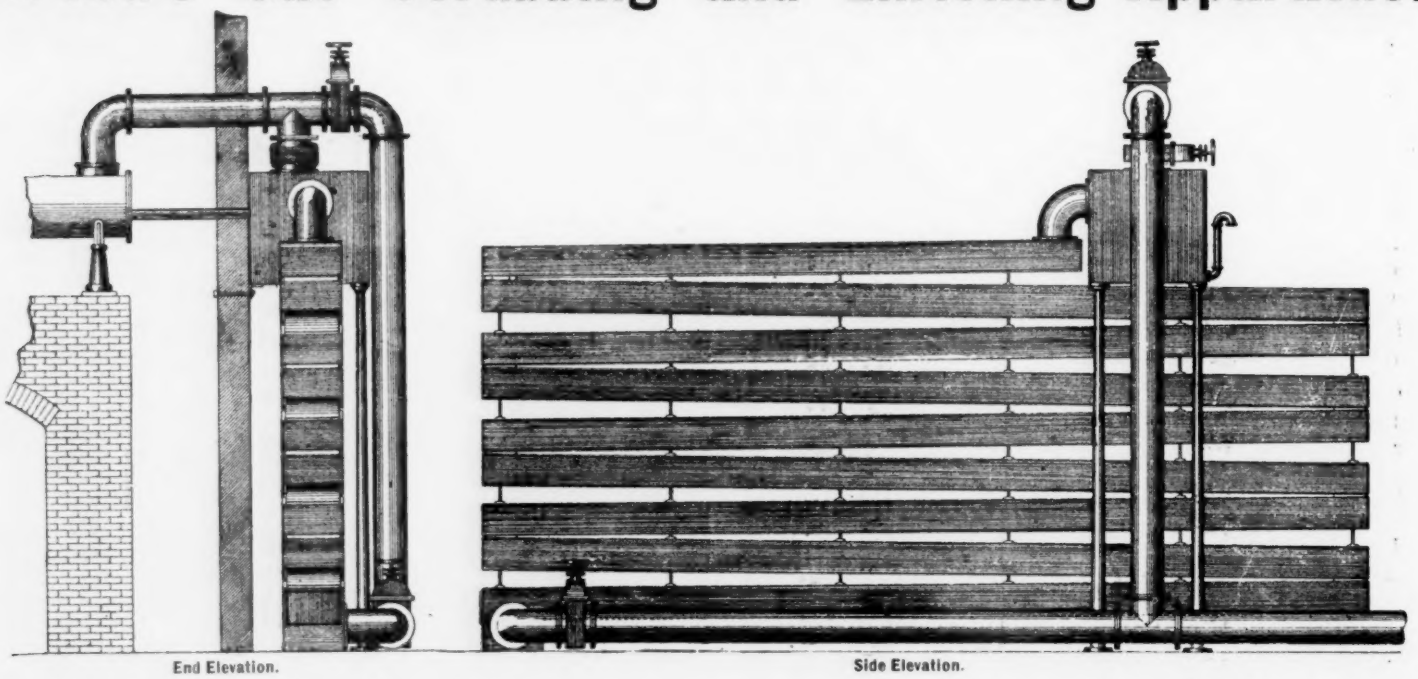

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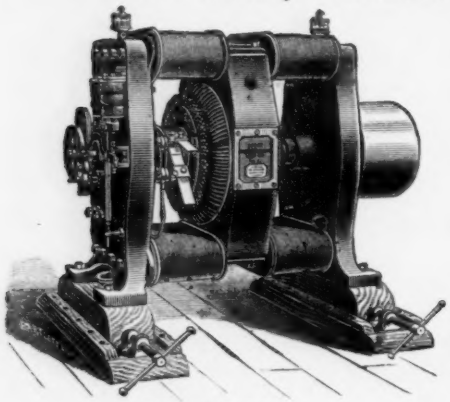

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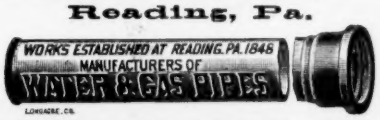

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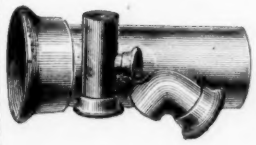

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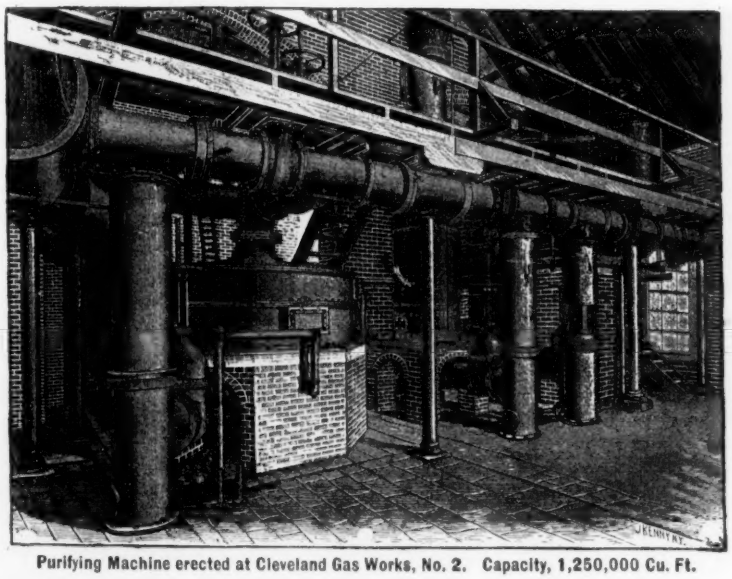

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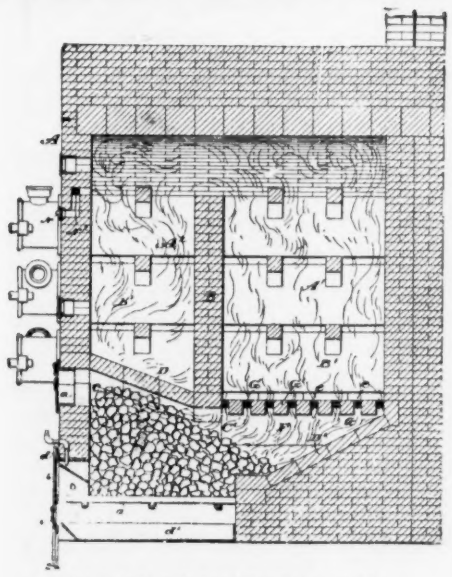

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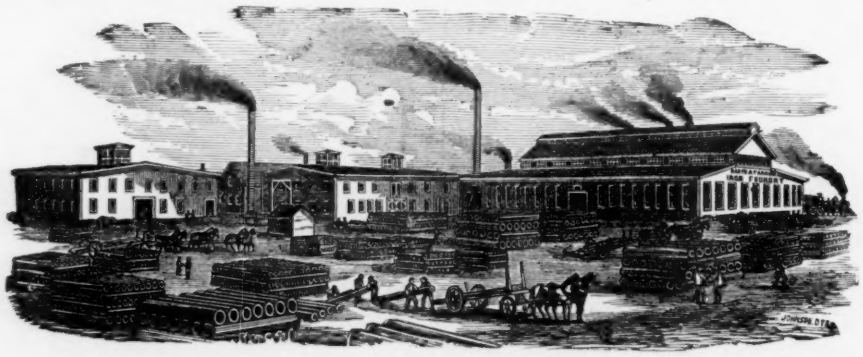

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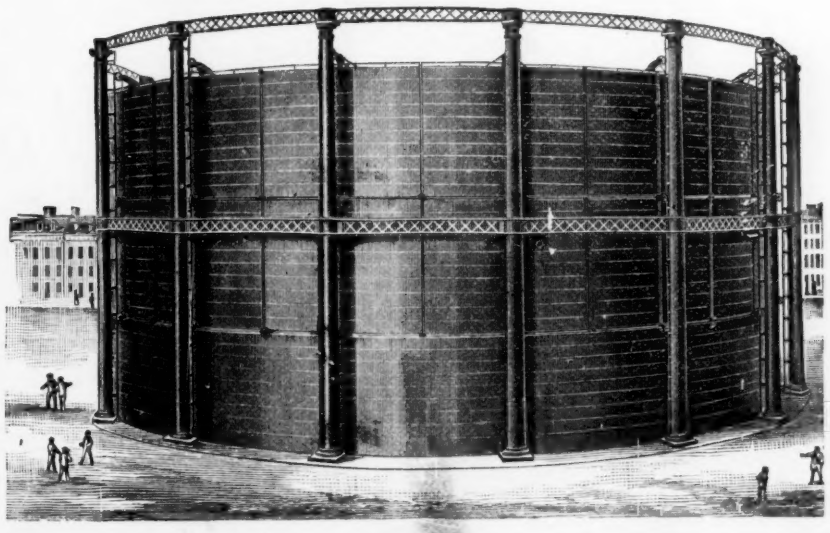

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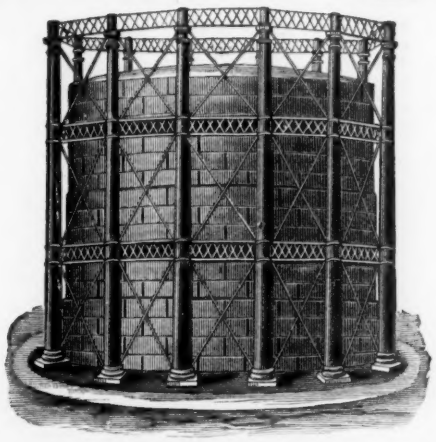

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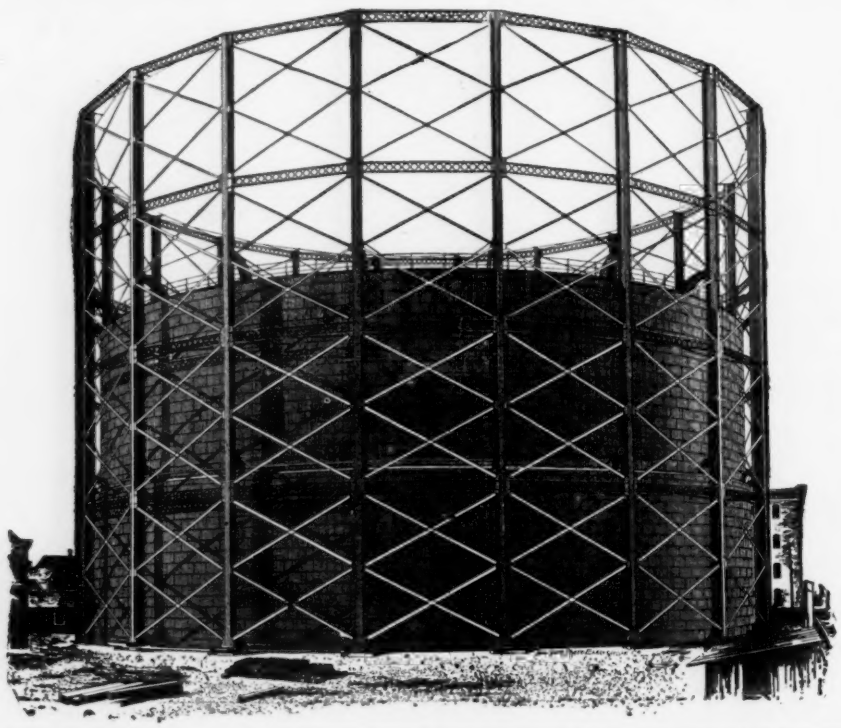

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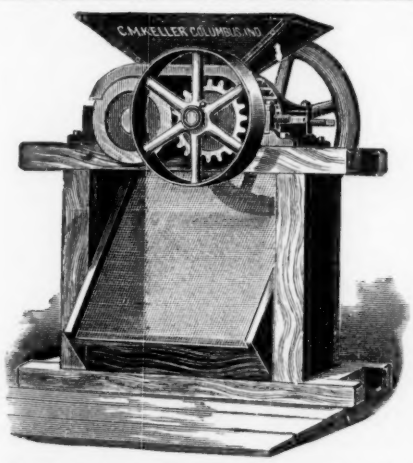

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